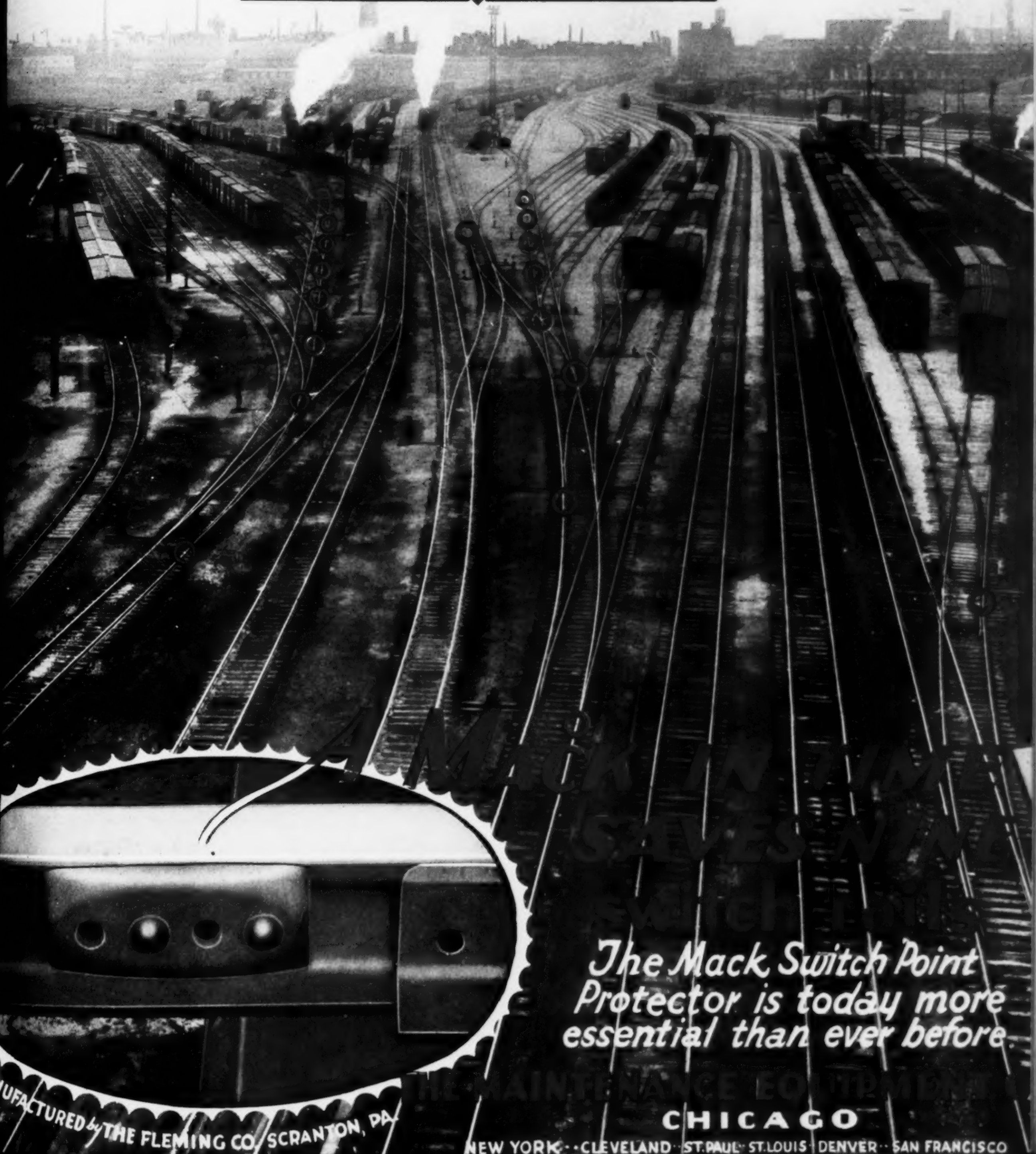
Railway Engineering and Maintenance

July, 1932



RAILWAY ENGINEERING AND MAINTENANCE
Published monthly by Simmons-Boardman Publishing Co., 2200 Port Washington Road, Milwaukee, Wisconsin. Entered as second class matter February 14, 1931, at the postoffice at Milwaukee, Wisconsin, under the Act of March 3, 1879.

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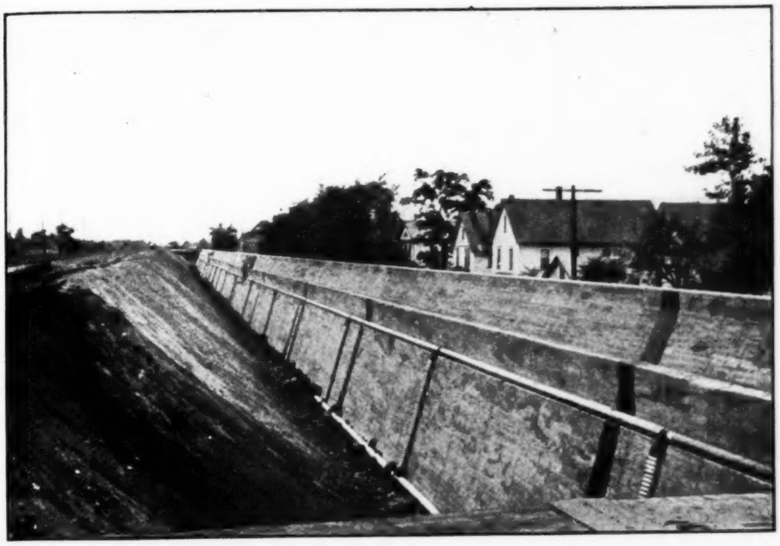
PROPER DRAINAGE

Given Foremost Consideration on this Job



When this wall was erected during a track elevation program at Kenosha in 1931, Armco Perforated Pipe was used to insure proper drainage.

ADEQUATE drainage is essential to the life and service of monolithic abutment walls. Water in the backfill affects economy of design, stability of the wall, durability of material.

Proper drainage of the above installation as of others all over railroad America has been economically accomplished with Armco Perforated Pipe. It protects and lengthens the life of the structure by carrying off the water as rapidly as it collects.

Armco Perforated Pipe has the strength to withstand heavy loads, and the flexibility to resist the forces of freezing and of settling fills.

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If you need a crib wall we recommend Armco Metal Cribbing—if you wish to use a high monolithic wall, we shall be glad to cooperate with you in planning an adequate and proper drainage system to insure its stability.

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Multi-Plate Pipe
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No. 43 of a series

Railway
Engineering and Maintenance
SIMMONS-BOARDMAN PUBLISHING COMPANY

105 WEST ADAMS ST.
CHICAGO, ILL.

June 30, 1932

Subject: Our Share of the Business

Dear Reader:

"I have nothing to complain about. I am getting my share of the business." In this cryptic statement, a railway supply friend of mine expressed his satisfaction with conditions within his own organization a few days ago.

This remark has been ringing in my ears ever since and I have been thinking a lot about it. In these days when everything is changing and nothing is static, I wonder if anyone can afford to be satisfied with "his share of the business," whether that business is the hauling of freight or of the selling of materials to the railways that haul the freight.

When William Wrigley died a few weeks ago, everyone thought of the monumental buildings that he had built in Chicago, from the profits of chewing gum sold at five cents a package. Mr. Wrigley was a successful man. More than that, he was characteristic of those men who demand success. He did not invent chewing gum; it had been produced and sold long before he entered business. He merchandised it more aggressively than it had ever before been merchandised, however, and in so doing so far overshadowed those who preceded him that his name became synonymous with the chewing gum industry. In his sales psychology there was no place for "his share." He continually strove for the maximum and in this set an example of courage and aggressiveness that can well be considered in these days when so many companies are running to cover. This is a day for fighters in every line of endeavor.

Yours truly,

Elmer T. Howson

Editor.

ETH*JC

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Here They Are!

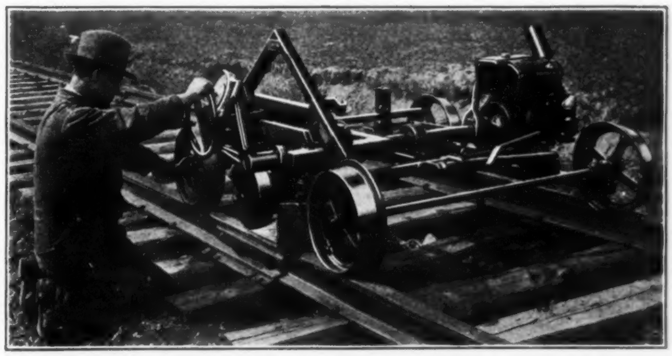
Two Grinders For Your Rail Welding Jobs

When building up rail joints, the new Nordberg Rail Grinder is just the machine for which you are looking. It was developed to put a perfect "top" on welded joints—do a better job and in less time, too.

It is lighter in weight than any similar machine. Careful design and the selection of newer materials assures sturdiness and strength.

Its ease of control appeals to all operating men. It is easy and simple to operate and will do the smooth job you are after.

With this grinder, one man can grind 80 to 120 joints per day. With portable attachment, the machine can also be used for beveling and slotting joints and for grinding flow at switches and stock rails. It can be furnished with either a four or eight horsepower engine.



Nordberg Rail Grinder

The Nordberg Cross Grinder is another machine that you also need for that welding gang. This compact little outfit, when fitted with a narrow grinding wheel for beveling or slotting joints to prevent chipping, will slot 60 to 80 joints an hour. With a cup wheel it is a fast and satisfactory means for removing flow at switches and stock rails. One man can easily grind 10 to 18 switches per day.

The flexible shaft will reach the joints of either rail. It is easily rolled along the rail from joint to joint and one man easily removes it from the track.

For welding jobs, slotting joints, and switch maintenance these two Nordberg Grinders will improve the quality of the work and with less expense.

Nordberg Cross Grinder

May we send you further information, also particulars on other Nordberg Maintenance Machinery?

Railway Equipment Department

NORDBERG MFG. CO., Milwaukee, Wis.

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2200 Port Washington Road, Milwaukee, Wis.

Editorial Office
105 West Adams Street, Chicago

NEW YORK
30 Church Street

CLEVELAND
Terminal Tower

WASHINGTON, D. C.
17 and H Streets, N. W.

SAN FRANCISCO
215 Market Street

Subscription price in the United States and Possessions, 1 year, $2.00, 2 years, $3.00; Canada, including duty, 1 year, $2.50, 2 years, $4.00; foreign countries, 1 year, $3.00, 2 years, $5.00. Single copies, 35 cents each.

Member of the Associated Business Papers (A. B. P.) and of the Adult Bureau of Circulations (A. B. C.).

Entered at the postoffice at Milwaukee, Wis., as mail matter of the second class.

Printed in U. S. A.

Railway Engineering and Maintenance

NAME REGISTERED U. S. PATENT OFFICE

JULY, 1932

Railway Engineering and Maintenance

TRAFFIC

Employees Can Do Much to Hold It

ALTHOUGH the system of regulation which has been forced on the railways is based on the theory that they render a monopolistic service free from competition, this condition is no longer true, if, in fact, it ever existed. Today the railways are confronted with competition at every turn, buses for both short and long haul passenger traffic, trucks for less-than-carload and also for bulk freight, barge transportation on the inland waterways, steamship service through the Panama Canal for traffic moving from one coastal area to the other, and air transport service for mail, express and passenger traffic.

All these agencies are competing actively with the railways and they are attracting business away from them in measureable volume. To the extent that they are successful in this endeavor, they are limiting employment on the railways and contributing to the reduction in personnel, a reduction which has already exceeded 700,000 persons in the last six years, including more than 200,000 employees in the maintenance of way and structures department.

Such a development is of very direct concern to every railway employee, as has been pointed out repeatedly in these columns. It is of scarcely less concern, although less generally appreciated, to the rank and file of business men and citizens in general throughout the country by reason of the effect on their own welfare of the decrease in the purchasing power of the vast army of railway employees who have either been laid off or placed on part time for the purpose of distributing the available employment to as many as possible.

Railroad Towns

If one surveys the towns and cities of the country, he will be struck with the large number of so-called railroad towns or those in which the railways are the main source of employment. If to this be added the thousands of villages and hamlets where the pay checks of the agent and the track forces constitute the major if not the sole payroll, one gains some appreciation of the influence of the railroad payroll on the prosperity of many communities in our country.

The influence of this payroll ramifies every industry. The variety of the purchases of an individual employee and the number of persons who are benefited thereby, is illustrated by the following record of purchases compiled by a statistically minded station agent in a small town on the Milwaukee railway during 1931 from the day-to-day expenditures of his own family, all of which were made in his home village except the last item:

Clothing	$ 9.25
Groceries and meats	40.74
Dry goods and groceries	17.35
Variety store	12.50
Groceries and fruit	20.44
Groceries and dry goods	5.30
Groceries and meats	189.87
Groceries and bakery	100.02
Shoemaker	10.00
Drugs	9.25
Drugs	23.60
Milkman	98.21
Hardware	20.22
Hardware	4.25
Hardware	10.95
Garage	4.76
Gas and tires	60.39
Gas and oil	3.00
Tobacco	5.90
Candies and ice cream	3.00
Box rent	1.80
Dentist	27.00
Physician	13.00
Ice	24.00
Chicken feed	2.00
Fuel	19.60
Fuel	6.97
Building material and fuel	79.85
Cleaner	6.75
Barber	8.65
Meals	3.00
Light and water	64.58
Interest	113.50
Principal	250.00
Taxes	68.73
Church	35.00
Donations	12.00
Newspapers	2.00
Labor	19.20
	$1,406.63
Purchases in nearby towns	108.79
Total Expenditures	$1,515.42

Such a list, when duplicated by the more than a million employees scattered in every village from Maine to California, constitutes an influence of the first degree on the business life of the country. Is it to the interest of the business life of the country, therefore, that such widespread buying power shall be allowed to decline as it has done during the last few years? If it is not, whose concern is it most directly to see that the public is adequately informed in order that it may so route its traffic and take such other remedial measures as may assist in arresting the present trend to competing agencies. Certainly there is no one more directly interested than the railway employee.

A railway employee can render no more effective service in his own behalf than by pointing out to those in his

community who are in a position to patronize the railways that it is to their interest to ship and travel by rail and thereby make possible the continuation of a railroad payroll in their town. He can also emphasize the further fact that every passenger or every shipment of freight that goes by other than rail decreases to that extent the ability of the railways to provide employment and likewise the ability of railway employees to make normal purchases and maintain trade in the community.

One difficulty with the railway situation today is the fact that those who patronize other transportation agencies do not realize that the diversion of their individual shipments is of any direct effect on the railways, whereas it is the multiplication of those individual losses that has gone a long way to put the railways in their present plight and to put competing forms of transportation on their feet. It is only as the proper appreciation of this fact grows that the traffic of each individual patron will be so routed as to promote his individual interest, viz over the railways.

WORK EQUIPMENT

Is It Being Used with Maximum Efficiency?

AN ACCOUNT of the standards of construction and current practices in other lands, like that by Sir Gordon Hearn, on page 453 of this issue, nearly always gives rise to comparisons that are decidedly unfavorable to the works and ways of foreign peoples. This is only natural; an individual measures the practices of others in the light of the physical circumstances with which he himself is familiar, forgetting that the men in other countries may be confronted with entirely different conditions.

An illustration that has frequently been cited to explain such differences in methods, is the fact that a higher cost of material and a lower cost of labor in Europe are the prime justification for types of construction that are highly expensive in labor and for the failure to adopt labor-saving equipment. Times, however, are changing and as will be noted in the article on the French railways, power tools are being employed in at least some measure.

In the meantime, a marked change has taken place in this country. Power equipment, originally forced on many railways by the sheer necessity of getting work done with a few men because more were not available, is now compelled to demonstrate its worth in the face of an unlimited supply of labor. Thus, our position with respect to the use of power tools does not differ greatly from that prevailing in Europe. It is no longer a question of doing more work with less men, or of the performance of tedious tasks which men were reluctant to do by hand; instead the one question is—Will power tools perform the work for less money than hand labor, other conditions being equal?

In view of the fact that maintenance of way officers have long based their recommendations for the purchase of power equipment on the savings to accrue from their use, the reader will naturally ask why this question should be raised at this late date. The point is that the need for saving money is now so pressing that every operation must be tested in the light of cold facts to make certain that the work is being done for the least money. This does not mean that the use of modern labor-saving equipment is under fire, but rather that the manner of its use is being put to test. The question which every maintenance officer must ask himself is—Am I using my equipment in a way that will assure the maximum saving in operation?

CLEARANCES

Encroachments Must Be Carefully Avoided

THE design of a signal bridge recently gave rise to much more than ordinary study because of the close spacing of the tracks between which it was necessary to place one of the legs, and after resorting to unusually slender construction for this leg with a correspondingly greater stiffness of the opposite leg, the bridge was erected. A short time later, much to the amazement of the bridge department, it was found that the signal department had used the slender leg as the support for a relay box that projected a foot inside the clearance limits to which the designer had been restricted. Needless to say steps were taken immediately to have the box removed.

This incident directs attention to a responsibility of the maintenance of way department in watching for encroachments. It is, of course, natural for a maintenance officer to assume that the forces engaged in construction work "know what they are doing" and are proceeding within their authority, but it not infrequently happens, as in this case, that somebody makes a mistake, which means that somebody else has to catch it. As the custodian of the property placed in his charge, the maintenance officer must be on the alert to watch for such deviations from standard structural limits.

INSULATION

Can Be Made to Pay Liberal Dividends

WHILE it is universally recognized that comfortable temperatures must be maintained in railway buildings which serve the public or house employees, building officers have been slow to avail themselves of a simple means of meeting this fundamental requirement and at the same time of reducing the amount of fuel that must be burned to maintain the desired temperatures.

It is widely, but mistakenly, believed that a dead-air space in the exterior walls of buildings provides ample insulation to exclude cold in winter and heat in summer. It is true that still, dry air is such a poor conductor of heat that it is used as the basis for measuring the relative value of insulating materials. Air offers practically no obstruction to radiation, however, and this is one of its properties which makes the air space in walls of little, if any, insulating value. Again, from a practical standpoint, it is impossible to construct an absolutely dead-air space. Tests have shown that convection currents are set up as soon as there is a temperature gradient between the opposite confining surfaces, which immediately increase the thermal conductivity of the air.

Another erroneous belief is that most of the heat losses result from convection and the leakage which is always present in this form of construction. It has been demonstrated, however, that more than 50 per cent of the heat losses in an ordinary well-constructed building are due to radiation and that the remainder are divided between conduction, convection and leakage. On the other hand, if the larger space is broken up into very small units so that convection is eliminated or at least retarded, the insulating value is correspondingly increased.

Advantage is taken of this fact in the manufacture of insulating materials so that both fibrous and cellular insulation containing minute dead-air spaces are available as building materials. Recent tests made by the Bureau of Standards indicated that the addition of ½ in. of standard insulation of either type to the roof, walls and floors of a building will reduce the fuel requirements for heating by 20 to 30 per cent. This saving can be realized, however, only if the insulation is applied in addition to the regular materials of construction and not as a substitute for any of them.

Obviously, this addition will increase the cost of the building and the annual interest charges. It has been found in practice, however, that the reduction in the cost of the heating plant, by reason of the smaller capacity required, is about equal to the cost of the insulation. For this reason, any saving that is made in fuel is clear gain. There is a further advantage in the insulation of buildings in that it tends to exclude the heat of the summer.

To obtain the maximum benefits from insulation, it is essential that building paper also be applied to retard the leakage of the warm air from the interior and the infiltration of cold air, particularly on windy days. No matter how effective an insulating material may be in retarding conductance, much of its effectiveness is lost unless provision is made to eliminate leakage and infiltration.

POWER TOOLS

Use Facilitates Timber Trestle Maintenance

IN VIEW of the constantly increasing necessity for obtaining maximum productive output per man-hour worked, maintenance officers can well afford to give serious study to the advisability of providing power-driven hand tools for gangs which are engaged in timber trestle maintenance. Where they have been used, they have been found to be of decided advantage in this class of work, and cases have been reported where they have been able to reduce the labor cost as much as 30 to 40 per cent. Futhermore, in addition to facilitating the operations, it is the general experience that the quality of the work is more satisfactory.

It will probably not be desirable to equip every gang engaged in this class of work with such tools, since the assignments of some will include little work for which power tools are adapted. There are relatively few divisions, however, which do not have sufficient work of a character to justify the purchase of sawing and boring tools.

Where conditions make it inadvisable to assign such tools permanently to individual gangs or divisions, one or more complete outfits for use on a more extended territory may demonstrate large economies. The power plants should be of sufficient capacity to meet all demands that may be made upon them. They should have a full complement of sawing and boring tools in several sizes, while in many cases a percussion tool can be employed to advantage in driving drift bolts or spikes. If more than one outfit can be justified, one or more of them should be smaller with a power plant capable of driving one saw and one boring machine simultaneously. By transferring this equipment from one gang to another as needed, or in accordance with a regular schedule, it can be kept at work during the season, even during this period of drastic retrenchment, and thus earn an attractive profit.

One of the definite advantages of power-driven woodworking tools on roads which do not maintain an organization for preframing bridge timbers for treatment, is that regular gangs can be assigned temporarily to this work and do the necessary framing and boring at a relatively low cost, whereas the cost might be considered prohibitive if the work is done by hand.

OBEYING RULES

Supervisory Indifference Breads Laxity

IN ANSWER to a question as to how far he went in insisting that trackmen wear goggles and the conditions under which this was required, a supervisor replied that he had issued a standing order specifying when this should be done; but added, "You can't get the men to wear them." On another road, a master mechanic complained that certain maintenance of way employees who sharpened tools occasionally in his shop were not wearing goggles as required. A few days later when his attention was called to the fact that his own men were equally negligent when using the same grinding tools, he replied in the same pessimistic strain as the supervisor. It was noted, however, that even after his attention was called to this evasion of a specific rule, he took no action to compel its observance.

In both of these cases, it is obvious that the reason for the general failure to observe a specific rule was to be found in the attitude of these two supervisory officers. No rule should ever be formulated unless there is a fundamental need for it, but after it has been issued, its observance should be required. Railway management does not have the constant and intimate contact with the rank and file that will enable it to enforce rules successfully. This duty must, therefore, devolve upon supervisory officers and minor supervisory employees.

Experience has shown that the attitude of a superior officer, whether it tends toward laxity or strictness, is always reflected by the organization which he heads. An indifferent officer or one who is a poor manager invariably has a loose and inefficient organization while a good manager who is a strict disciplinarian will convert this same organization into one that is alert and that will function with much higher efficiency.

Likewise, if a supervisor does not take rules seriously enough to require strict obedience, it is certain that the foremen will reflect this attitude and that enforcement will be lax or non-existent. This is a rule that works both ways, however, so that where an indifferent supervisor is found, it may be well to investigate also the attitude or ability of the officer to whom he reports.

How Long Do Treated Ties Last?*

Burlington develops an interesting record covering the performance of treated timber for a service period of over 22 years

THROUGH detailed annual inspections, which have already extended over a period of 22 years, of 24,875 experimental ties in 25 widely separated locations on its lines, the Chicago, Burlington & Quincy is determining the relative merits of 20 different tie timbers, both untreated and treated with various preservatives. Indicative of the fund of valuable information that is being acquired, is the summary contained in the twenty-second annual report, dated January 1, 1932, that after 22 years, 30 per cent of the treated ties still remain in the track, while only 8, or 0.24 per cent, of the untreated ties are still in service, and that these untreated ties had an average life of only 5.8 years.

The 24,875 experimental ties included 21,604 that were treated and 3,271 that were installed without treatment. Of the treated ties removed, only 5,707, or 26.4 per cent, of the original number failed as a result of decay, while 9,468, or 43.8 per cent, were removed for other reasons, including rail cutting, splitting, breaking, burning, shake, and damage from derailments or other external causes. As contrasted with this performance, 2,946, or 90 per cent, of the untreated ties failed by reason of decay, and only 317, or 9.7 per cent, were removed for other causes.

Establish Life of Untreated Ties

Since so few of the untreated ties remain in service, it has been possible to determine definitely their average life as a whole and that of each of the 20 different woods which were included in the test. These averages ranged from 2.9 years for cottonwood to 11.4 years for white oak. The average life for the entire lot of 3,271 untreated ties was 5.8 years, and it is of special interest that the average life of the ties from 11 of the 20 woods represented differed by less than one year from the average life of all of these ties. Since 30 per cent of the treated ties remain in service, the average life of these ties has been forecast by means of the scale for measuring the life of ties developed by W. F. Goltra, and the results of these calculations are shown in the table.

These 25 test sections do not, however cover all of the experimental work that the Burlington is doing in an effort to determine the character of the timber and the types of treatment that are best suited for its conditions. As an indication of the magnitude of the experimental work it has undertaken, other test installations of ties have been made, some of them covering a period of 30 years, as well as of piling, bridge material, crossing plank, water tanks, flooring and building material, until at present there are 208 tests under way or completed, including 106 installations of ties, 62 of crossing plank, 2 of water tanks, 29 of bridge material including piling, 7 of piling alone and 1 each of flooring and building lumber. Since 1929, ZMA has been used by the Burlington as a preservative in addition to creosote and zinc chloride, and 10 of the test lots of ties, 41 of crossing plank and 4 of bridge material and a number of poles have been treated with this salt.

While it was desired to obtain data as to both the relative and absolute life of treated and untreated ties, the primary purpose of the test was to secure reliable information on the performance of ties made from different woods, treated by different methods and installed under the varying conditions of climate and traffic which obtain on this system.

To accomplish this purpose, ties made from 20 different kinds of woods were subjected to treatment by each of the methods employed, while a smaller number of each kind was installed without treatment. These ties covered a wide range of hardwoods and softwoods, some of them being made from woods that are not ordinarily used for tie purposes, including ash, cottonwood, elm, hickory, soft maple, poplar and sycamore. The other woods included in the test were beech, birch, chestnut, cypress, red gum, hemlock, hard maple, white oak, red oak, pin oak, loblolly pine, tamarack and tupelo gum.

To insure that every condition likely to be encountered on the system would be included in the test, installations were made on every division. Each of the test sections included approximately 1,000 ties, of which about 15 per cent were untreated. Each test tie was marked with a dating nail which also carried an arbitrary character that indicated the kind of wood and the treatment used. As a further precaution against confusion and to insure a permanent record, a diagram was prepared for each of the test sections, which shows the exact location of every tie. Also, to insure that a complete history will be obtained of every one of these ties when a foreman removes one of them he is required to report its location, the kind of wood, the treatment and the cause of failure.

Supervise Removal of Ties

As a further precaution in keeping a correct record of these experimental ties, the foreman is allowed to remove them only under the supervision of the roadmaster after the annual inspection, except in cases of emergency such as destruction by fire, by a derailment or other external cause. When removal becomes necessary under these circumstances, the roadmaster is required to inspect the damaged ties promptly, making a full report of their condition and the reason for their removal. They are then held until disposition is arranged for by the superintendent of timber preservation.

For operating purposes, the Burlington is divided at the Missouri river into two grand divisions. Because of the marked difference in climatic conditions east and west of the Missouri river, the records of the experimental ties have been kept separately for these grand divisions. On the lines east of the Missouri river, the annual rainfall ranges from 30 to 35 in. in Illinois, Wisconsin, Minnesota and Iowa, to 35 to 40 in. in Missouri. In contrast, on the lines west of the Missouri river, the precipitation decreases progressively from Eastern Nebraska to an average of 15 to 20 in. and even less, in the

*Reference to previous reports on these installations will be found in *Railway Engineering and Maintenance* for February, 1924, p. 61, and in the August, 1929, issue, p. 301.

On the La Crosse Division of the Burlington

western part of that state and in Colorado and Wyoming.

It is interesting to note that despite these climatic differences the average life of the untreated ties was the same for both grand divisions, while the percentages removed for decay and for other reasons were almost identical. As might be expected, with one exception, a smaller percentage of the treated ties failed from decay than were removed from other causes. This exception was the ties treated with zinc chloride and installed on the lines east where the precipitation is higher. In Wyoming, other ties treated by this process have given similar results when installed near irrigation ditches, where the water in the soil causes the zinc chloride to leach out, and gives decay-producing organisms an opportunity to attack the wood.

Among other interesting information to be gleaned from the report is the performance record of some of the woods which are not generally considered suitable for tie purposes. While the life of untreated cottonwood was only 2.9 years; of sycamore and tupelo gum, 3.6 years each; of birch and soft maple, 3.9 years each; and of tamarack, 5.5 years; the performance of all of these woods indicates a greatly extended life when treated with straight creosote or by the Card process, the former method of treatment giving the longest estimated life.

Based on their performance to date, the cottonwood ties treated with straight creosote are expected to have an average life of 27 years on both grand divisions, and of 20 years when treated by the Card process (½ lb. of zinc chloride and 3 lb. of creosote). The estimated life of the hickory ties is 30 years; of the elm ties, 27 years; of the loblolly pine, 25 years; of the sycamore, 26 years; of the tamarack, 21 years; and of the tupelo gum, 23 years; these estimates all being for ties treated by the full-cell process with straight creosote. This compares with an estimated life of 21 years for white oak ties treated with straight creosote and installed on the western lines and of 44 years on eastern lines.

Of the 25 test sections, 18 are on lines east and 7 on lines west. The performance of these ties is shown in the table which is classified as to the methods of treatment, but not as to woods.

When considering these results, it is well to bear in mind that at the time these installations were made, tie plates were not used extensively and those that were in use were much smaller than at present. As a matter of fact, tie plates were not applied on a number of these installations until four or five years after they were completed. Likewise, anti-splitting devices had not yet come into use.

Summary of the Record to Date

Process	Total Placed	Total Out to Date	Percentage of Original Ties Removed: By Reason of Decay	For Other Reasons	All Causes	Est. Aver. Life Years
Lines East						
Straight creosote ...	2,046	795	12	27	39	24.8
Card process	10,243	7,158	24	45	69	19.67
Burnett process (zinc chloride)..........	1,578	1,380	47	41	88	16
Untreated	2,045	2,039	89.7	10	99.7	5.8
Total treated	13,867	9,333	25	42	67	20
Total all ties........	15,912	11,372	33	38	71	19
Lines West						
Straight creosote ...	1,237	600	15	34	49	23
Card process	5,591	4,378	29	49	78	18.17
Burnett process	909	864	46	49	95	14.33
Untreated	1,226	1,224	90	9.7	99.7	5.8
Total treated	7,737	5,842	29	47	76	18.5
Total all ties........	8,963	7,066	37	42	79	18
All Ties						
Straight creosote ...	3,283	1,395	13	29	42	
Card process	15,834	11,536	26	47	73	
Burnett process	2,487	2,244	46	44	90	
Untreated	3,271	3,263	90	9.76	99.76	
Total treated	21,604	15,175	26.4	43.8	70.2	
Total all ties........	24,875	18,438	34.5	39.6	74.1	

As a consequence, splitting accounts for the removal of more of the treated ties than failed from decay, with by far the larger number of failures of this type in the ties that were treated by the Card process, and a negligible number in the untreated ties. Rail cutting was next in importance as a cause of failure, other than decay, particularly in the softer woods, and this undoubtedly hastened the failure of many of the ties that have been reported as removed because of decay. As an indication that these ties were not hand-picked for the purposes of the test, shake is given as the cause of fail-

ure of the next largest number of the treated ties.

A test section containing 3,200 Douglas fir ties was installed on the Sterling division in Northwestern Nebraska in 1900, and a similar test was made with 3,120 fir ties laid in 1906 on the Casper division in Wyoming. Both lots were treated with ½ lb. of zinc chloride and laid in a semi-arid climate, the annual rainfall on the Sterling division averaging from 15 to 20 in., and on the Casper division from 10 to 15 in. The ties on the Sterling division had an average life of 21 years, the last of these having been taken out in 1930. On the Casper division, two of the ties remain, the average life for the lot having been 19 years.

In discussing these two tests, H. R. Duncan, superintendent of timber preservation, who compiled the report, said, "While our records show an unusually long life for fir ties, we cannot expect an average life as high as they seem to indicate, for the reason that these ties, in my opinion, were favored from the time they were made experimental until the test was concluded. I do not believe that it is possible to obtain an average life of more than 16 years from fir ties treated with zinc chloride in the territory served by our road."

Similarly, tests of western yellow pine treated with zinc chloride and installed on the same divisions showed an average life of 22 years and 19 years, respectively. After thoroughly analyzing the test data, Mr. Duncan expressed the same opinion with respect to this wood, on the ground that the long life indicated for these ties was in large measure due to the fact that they had been unusually well taken care of.

Experience with Lodgepole Pine and Yellow Pine

Beginning in 1923, the Burlington began to use lodgepole pine as tie timber, 17,000 ties having been purchased in that year. Annual receipts increased progressively to 116,000 in 1928, since which time they have been somewhat less, but they were still being received in large number in 1931. No test sections containing lodgepole pine ties have been installed, but the performance of many of those in the tracks has been observed and the conclusion reached that the results are likely to be disappointing. This timber has only a small percentage of sapwood, while the heartwood is highly resistant to the lateral penetration of preservatives. For these reasons, no more of this timber will be purchased until facilities for incising, boring and adzing are installed.

During the last few years many yellow pine ties have failed prematurely. Investigation of the causes indicates that most of them were treated with zinc chloride during federal control. However, others treated by the Card process with a retention of 2 to 3 lb. of creosote and installed as late as 1925, have also failed. These failures occurred in greater number on lines adjacent to the Mississippi and the Missouri rivers in territory having an annual rainfall of slightly more than 45 in. It was found that many of the failed ties had retained only a small amount of the original preservative in the treatable wood. It was the opinion that too small a quantity of the preservatives had been used in the treatment so that the retention of creosote has been raised to 5 lb. for yellow pine and the treatment changed to the Reuping process. It is Mr Duncan's opinion, as expressed in the report, based on observation of creosoted yellow pine ties under test on his own road and on inspections made of the same species given the same treatment on other roads, "that the amount of creosote retained should be increased still further, if full benefit is to be realized from the preservative treatment of yellow pine."

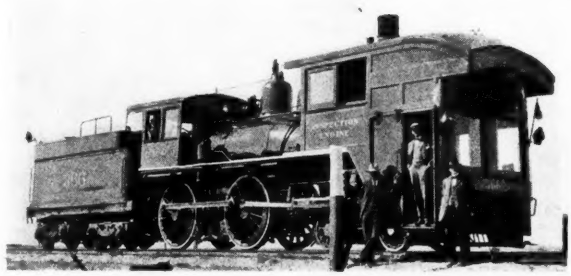
Included in the report was a somewhat detailed discussion of the many factors which affect the life of treated ties and other timbers. Because of its length, only an abstract of what was said on these subjects can be given, and this follows:

Preservative treatment will not materially improve a tie that is not manufactured properly or one in which decay is present at the time of treatment. To guard against the development of decay organisms during the seasoning period, the ties should be produced and kept under sanitary conditions prior to shipment. They should be moved into the seasoning yard promptly and kept under close observation until ready for treatment. They should be treated as soon as ready and all of the treatable wood should be penetrated thoroughly with the preservative. The amount of preservative used should be determined by the service demanded of the ties, that is, whether they are likely to be destroyed mechanically or to fail from decay.

Boring and Adzing Adds Two Years to Life

In the past, the life of the ties has been shortened by the damaging effects of driving cut spikes into them and by excessive hand adzing. Preboring reduces the destruction of the wood fibre from spiking, increases the holding power of spikes, and allows the preservative to penetrate the zone around the spike, where it is most needed. Pre-adzing provides a good bearing for the tie plate and eliminates the necessity of cutting into the tie, with the possibility that untreated wood will be exposed. It is estimated that this practice will add a minimum of two years to the average life of ties, and will produce an ultimate net saving of 21½ cents a tie over the period of its average life.

Much better results will be obtained during the life of the ties, and this life will be increased, by selecting



On an Annual Inspection of the Test Tie Sections

the timber and the type of treatment for the different conditions which prevail on different sections of a road. This selection should be made in the light of the species of wood available, taking into consideration the climatic conditions, the class of track involved, the tonnage to be carried, and the alinement, i. e., curve or tangent.

Many ties have failed in the past by reason of the use of too small tie plates, which has resulted in a form of damage similar to rail cutting. Tie plates on the Burlington have been increased in size until at present this form of damage is no longer a problem.

Both the physical and chemical properties of ballast have a direct bearing on the life of ties. While the Burlington has improved the quality of its ballast in recent years, the report recommends a more extensive use of gold-ore slag, chatts or crushed rock. While anti-splitting devices have been used heretofore, in 1931 the practice

was adopted of applying them to all hardwood ties as soon as they are yarded. They are applied to other ties also as soon as the need for them is evident.

Mention was made of the experience of this road with ties treated with zinc chloride in sections where there is sufficient moisture to leach the salt out of the wood. On the other hand, in certain sections of Wyoming where there is little rainfall and a minimum of moisture in the ground, much of the water of solution evaporates, leaving a concentration of the zinc chloride which causes the wood fibre to separate and broom. In other words, it was the conclusion that these ties had been destroyed chemically. As a corrective, the Card treatment has been extended to include this district.

For the last five years the annual tie renewals on the Burlington have averaged 162 to the mile, incidating an average tie life of 19 years. The opinion is expressed in the report that the recent installation of facilities for boring and adzing the 900,000 ties treated annually at the Galesburg, Ill., plant and the change from straight zinc chloride to the Card process for the Wyoming lines may be expected to increase this life to 20 years. It is further suggested that the boring and adzing of the ties treated at Denver, Colo., and Sheridan, Wyo.; the incising of the refractory woods which are used on the western lines; and the treatment of all ties to a retention of 8 lb. of a 50-50 mixture of asphalt-base petroleum and creosote, may be expected to extend the average life of all of the ties in service to 23 years. To do this, however, will increase the annual cost of treatment by $183,000 for 19 years, after which an annual saving of $283,000 should be realized.

Artificial Seasoning of Timber

During 1932, tests will be made to determine the advantages, if any, of artificially seasoning timber, and 50,000 semi-seasoned oak ties will be used in this experiment, which will be made at Galesburg. This will necessitate the substitution of the 50-50 petroleum-creosote mixture for the Card process (½ lb. of zinc chloride and 2 lb. of creosote) which is now standard. This will increase the cost of the treatment by 7 cents a tie. The artificial seasoning of piling and lumber is also under consideration.

Since 1928, poles have been treated with ZMA, at a cost of $1 a pole less than by the Reuping process with a retention of 8 lb. of creosote, which was the former practice. All poles have been framed and bored before treatment and this, added to the fact that the poles are clean and more easily handled, has resulted in a further reduction of $1 a pole in the cost of installation by the telegraph department.

Of late, invasions of termites have been found at 11 points on the Burlington, principally in stations and freight houses. Both the wood preservation and the engineering departments are making a study of this subject. At one affected point where it was necessary to rebuild a freight house, treated timber was used in the reconstruction, and the effect of this measure is under observation.

All of the 208 test installations are inspected annually by the superintendent of timber preservation in company with the local and district maintenance officers. All of the test sections of ties and other experimental installations made prior to 1927 were installed by the late J. H. Waterman, superintendent of timber preservation until his retirement in 1927. Later installations and inspections have been made and the reports prepared by his successor, H. R. Duncan.

Large Rock Derails Train

AN UNUSUAL accident occurred on the Northern Pacific near Eddy, Mont., on March 18, in which a west-bound passenger train was derailed, two employees were killed and five passengers injured, as a result of a large rock striking the embankment and shoving the track out of line.

At the point of accident the line is single track and on a 12-ft. fill. The road is located close to the north bank of the Clark's Fork river, while to the north there is a mountain 2,384 ft. high, the crest of which is 2,960 ft. from the track. The mountain slopes toward the track at an angle of approximately 45 deg. to within 320 ft. of the track.

Evidence brought out at the investigation and reported to the Interstate Commerce Commission by W. P. Borland, director, Bureau of Safety, indicated that no trouble had been experienced previously from falling rocks at the point where the derailment occurred. Trouble of this character had occurred, however, a short distance west and for this reason, a detector fence, 794 ft. long, had been erected with its eastern end 517 ft. west of the point of derailment. As an added precaution, for more than a year a watchman had been assigned to patrol the track over a distance extending 1,400 ft. east and 5,427 ft. west of the point of derailment.

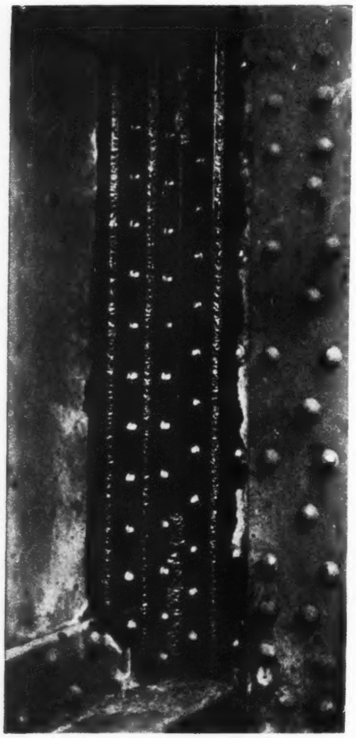
For several days prior to the accident, it had been raining and alternately freezing and thawing. At the time of the accident, which occurred at 5:40 p. m., it was dusk and raining. The watchman had been over his track three times between 3:45 p. m. and 5:40, and was near the western end of his patrol at the latter hour.

The train consisted of eight cars, and the locomotive, the first four cars and the forward truck of the fifth car were derailed. An immediate investigation disclosed a large hole in the embankment and across the track was a large boulder which had made the hole. There was no indication that it had struck the rails or ties, but it was apparent that the impact of striking the embankment had thrown the track out of line.

In his conclusions, Mr. Borland states that the rock "was of granite, 10 ft. by 8 ft. by 10 ft., with an approximate weight of 65 tons. Its path was easily traceable and its course was such that, coupled with the power gained from momentum and its enormous size and weight, nothing could have stopped it short of the railroad right of way.

"It struck at three different points in its downward course before it hit the railway embankment, the last jump being 163 ft. and apparently sufficiently high to clear the dispatcher's circuit. After hitting the north side of the fill, shoving the track out of line approximately 2 ft., it cleared the fill and came to rest in an old borrow pit on the south side of the roadbed, leaving a large hole in the north side of the fill. The loosening of this boulder was probably due to intermittent rains with changing temperatures, which caused alternate periods of thawing and freezing. The power line and some of the Western Union wires failed at 5:34 p. m., which fixes the time the rock fell.

"A slide-detector fence was located a short distance west of the point of accident, but if the fence had extended to and beyond this point, it would appear that it would not have been of any protection in this instance, since the path of the rock indicated that it bounded over the company's telegraph line and would, therefore, have missed the fence had it been located in its usual and logical position."



Arc-Welding Reinforcement of a Floor Beam and Stringer Connection

Use Arc Welding in Strengthening Repairing

Erie, Pennsylvania and Long Island find this process to be economical and effective in solving various problems

ONLY a few years ago the repairing and strengthening of metallic railway bridges by the electric arc welding method was so new that it was looked upon by many with skepticism. Today, however, it has been accepted by a number of roads as the most economical and effective method of doing many phases of such work. Among the roads which have used the welding method quite extensively are the Erie, the Pennsylvania and the Long Island, while several other roads, including the Reading and the Lehigh & New England, have used it to advantage in special instances.

On the Pennsylvania and the Long Island, attention has been confined largely to repair work of girder spans, although some strengthening has also been done, while on the Erie, major attention has been given to the strengthening of viaducts and riveted truss spans. Each road has found the welding method well adapted to the classes of work it has undertaken and, in most cases, more practical and economical than other methods of obtaining the desired results. This article deals with the work done by these three roads on girder spans and viaduct towers. A later article will cover the application of arc welding to truss spans on the Erie.

Much Girder Strengthening Being Done

Through methods which have been developed in recent years, an unusually wide range of strengthening work has been done on girder bridges, viaducts and the girder floor systems of various types of bridges. This work has included not only the strengthening of the individual girders, but, in many cases, the strengthening of the connections between members.

At Akron, Ohio, the Erie strengthened a two-track, deck girder bridge consisting of two separate single-track spans located side by side; one of the spans, erected in 1903, being 95 ft. long and designed for the equivalent of about Cooper's E-40 loading, and the other, erected in 1911, being 101 ft. long and designed for the equivalent of about Cooper's E-50 loading. These spans were of conventional design except as to the make-up of the flanges, which had four angles instead of two, the secondary angles being placed with their outstanding legs 12¼ in. from the outstanding legs of the main flange angles in the case of the shorter span, and 11¾ in. on the longer span.

Strengthening of the spans was designed to permit the use of locomotives which would create a loading equivalent of about Cooper's E-73. This called for the addition of about 36 sq. in. of metal to each flange of the shorter span and 22.3 sq. in. of metal to each flange of the longer span.

Considerable strengthening of girder bridges had already been done on the Erie by the addition of cover plates and riveting, employing falsework to support the girders and jacks during the work, but this method was not feasible at Akron, because the bridge carried the tracks of the Erie over a number of tracks of the B. & O., an old canal and a large number of telegraph wires, so that there was no room for falsework bents. In view of this obstacle, and the further fact that the track structure would have to be disturbed in order to increase the cover plate area by the riveting method, it was decided to increase the flange section area by welding.

The Addition of Side Plates

Using this method, the additional flange section was obtained by welding side plates between the outstanding legs of the main and secondary flange angles at both the top and bottom of the girders. In the case of the 101-ft. span, two 1-in. plates were added to each flange, while in the case of the 95-ft. span, two ⅞-in. and two ¾-in. plates were added to each flange. In both cases the strengthening plates were set in outside the heads of the rivets through the vertical legs of the flange angles, and were spaced from the angles by means of short liner plates, suitably punched to go over the rivet heads. All of the strengthening plates were fillet welded throughout their lengths, both top and bottom to the outstanding legs of the angles. Splices of the flange strengthening plates were made by field-welded splice plates that developed the full strength of the new flange plates. (See Fig. 1)

In order to install the plates as described, it was necessary to remove a series of short stiffener angles between the main and secondary flange angles at both the top and bottom of the girders, and to notch or scallop the edges of the reinforcing plates at places to fit around the heads of the rivets connecting the cover plates to

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the main flanges. Most of this work was done in the field with an acetylene torch, as was also the shaping of certain of the plates to conform to the camber in the girders.

On the inside faces of the girder flanges, where gusset plates connected the intermediate cross frames to the girders, it was necessary to cut away the gussets to permit the placing of the reinforcing plates. After the plates were welded in position, the parts of the gussets removed were replaced and welded to the frames and the flanges of the girders.

Altogether, 63,000 lb. of reinforcing plates was added to the two spans and 2,460 lb. of welding rod was used. All of the work was done from scaffolding supported on temporary steel brackets spot-welded to the stiffeners, and without interference with traffic.

Long Island Strengthens 14 Girders

Another rather similar use of the welding method was employed on the Long Island in connection with the strengthening of the girders of four deck girder spans and three half-through girder spans on a section of line where it was desired to use heavier power. Calculations showed that additional flange section was necessary in both top and bottom flanges of the girders to avoid excessive stresses under the heavier loading.

To provide additional material in the bottom flanges of the girders, a 4-in. by 3/4-in. steel bar was welded against each side of the web, parallel with and just above the flange angles. These bars were brought to bearing against the web of the girder by burning slots for them in the stiffener angles. Continuous fillet welds were made along the tops of the bars, and between the bars and the cut stiffeners, and stitch welding was used along the bottoms of the bars.

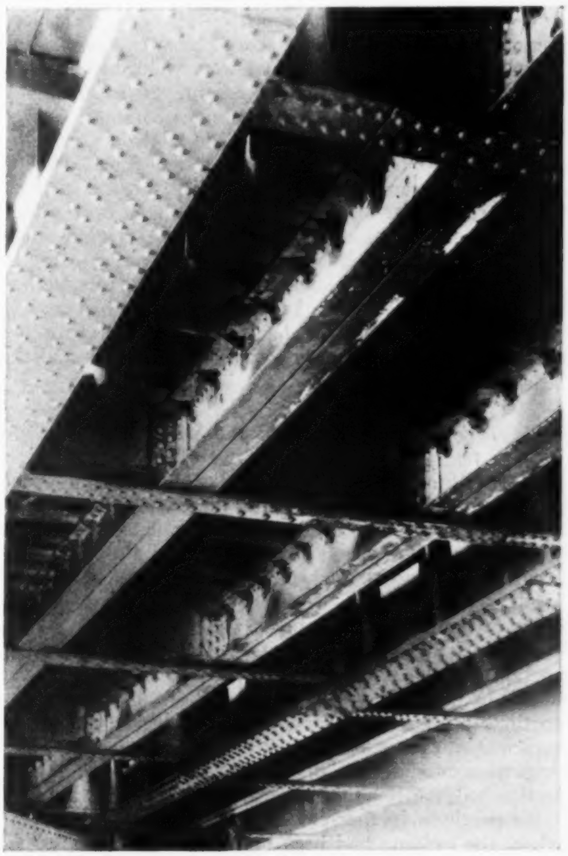
Increased metal was provided in the top flanges by welding a 3-in. by 2½-in. by 7/16-in. full length angle against the edges of the stiffeners directly beneath each edge of the cover plates, the angles being used instead of bars in this case to increase the lateral stiffness in the compression flange. In this position, the outstanding legs of the added angles extend beyond the edges of the cover plates, for the greater convenience of flat welding the angles to the edges of the cover plate. The angles were also fillet welded to the bottoms of the flange angles, a 3/8-in. weld being used in each case. (See Fig. 2.)

Further work was done on the half-through girder spans to increase their lateral stiffness, since the original round-rod laterals had become loose in many instances and were difficult to tighten. The old rods were replaced by angles, which were welded to the bottom flanges of the girders and at their own intersection, and, in some cases, it was possible to weld them also to the bottoms of the stringers.

The more common method of strengthening the flanges of girders, beams and stringers in contrast with those which have been described above, is to add cover plates. When the new plates must be applied against existing cover plates, they are, if possible, made narrow enough to lie between the two inside lines of rivets. Since, in some cases, it is impracticable to do this, wider plates must be provided in which holes are punched to receive the rivet heads, these holes being filled with weld metal after the plates are in place to serve as stitch welds and to exclude moisture. This latter consideration is of particular importance where the members face upward and might retain water.

In order to provide an angle junction between the new plates and the old metal for the fillet welding, it is customary to provide new cover plates that are either narrower or wider than the flanges to which they are applied. Furthermore, to secure the advantage of flat welding whenever possible, it is common practice to make the reinforcing plates for the bottom flange wider than the bottom flange and, for the same reason, to make the reinforcing plate for the top flange narrower than the flange. With the particularly wide plates, slots are usually provided through the center line to afford additional points of fastening. These slots vary in size and spacing with the width of plates, but are usually about one inch wide and from two to three inches long, and spaced from two to three feet apart.

On the Lehigh & New England, in connection with the use of heavier power, it became necessary to strengthen a long single-track bridge at Portland, Pa., which consisted of one deck girder span over a two-track railway, six deck truss spans over the Delaware river and



Repair of Built-Up Stringers in a Half-Through Girder Bridge on the Pennsylvania Showing Small Gussets Welded in Place to Stiffen the Outstanding Legs of the Flange Angles

a viaduct of 32 spans. The girder span was 104 ft. 6 in. long and both of its girders were of ample strength except for inadequate riveting of the web splices. To overcome this weakness, the existing splice plates were fillet-welded to the web plates along both edges, a 3/8-in. weld being used. The hangars of the truss spans were strengthened with 5-in. by 1/4-in. and 6 3/4-in. by 1/4-in. plates, all 6 ft. 6 in. long, welded to the webs and the edges of the angles.

The strengthening of the shorter spans was limited to the reinforcing of the end stiffeners. This was effected by welding 5-in. by 5/8-in. bars against each side of the web, close to the existing stiffener angles. These bars

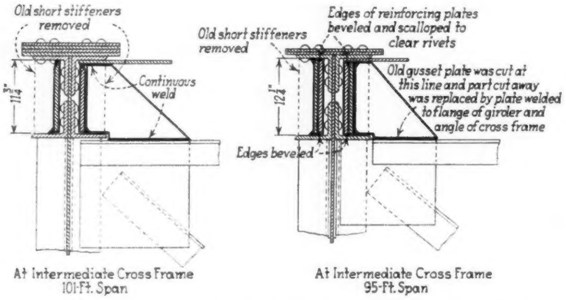


Fig. 1. The Application of Side Plates to Increase the Sectional Area of a Special Type of Girder Flange

were fillet-welded continuously to the web along one side, where the edge was chamfered. The small space between the new bars and the existing stiffeners made welding along both sides impracticable, but to offset this, three plates, 1 1/2 in. by 1/4 in. by 4 1/2 in., were placed horizontally in each of these spaces between the existing stiffeners and the new bars, and were welded to the new plates, the girder webs and the existing stiffener angles.

Work of this same general character has been carried out on a considerable number of deck girders, ranging from 30 to 40 ft. in length, on the New York division of the Pennsylvania. On this road, however, the stiffener bars were stagger-welded to the webs and were added more in the way of repair to restore the original load-carrying capacity of the girders than to increase it. In most of the cases on the Pennsylvania where this method was used, the lower ends of the end stiffeners had become corroded and battered or bent upward, and were not transmitting loads properly to the lower flanges and the bearings..

Flange Angles Repaired and Strengthened

One of the most interesting classes of repairs which have been made by welding on the Pennsylvania is in connection with the repair of the top flange angles of stringers in half-through girder bridges. In a large number of cases, especially where wide angles were employed, bending action in the ties had caused cracking in the fillets of both top flange angles.

In repairing this condition by welding, the cracked portions of the fillets were burned out by an acetylene torch, back to the heel of the angle, and the cut-out portions were then welded. In making these welds, sufficient weld metal was used not only to restore the original section of the fillet, but to enlarge the fillet in section to give it added strength.

To preclude further cracking in the angle fillets, both where the welding had been done and where cracks had not yet developed, a novel method of strengthening was used. This method, which is covered by patents, consists of welding small triangular steel brackets or gusset plates between the outstanding legs and the vertical legs of the angles, one directly under each tie on each side of the stringer, except where cracks had developed, where the spacing was made somewhat closer.

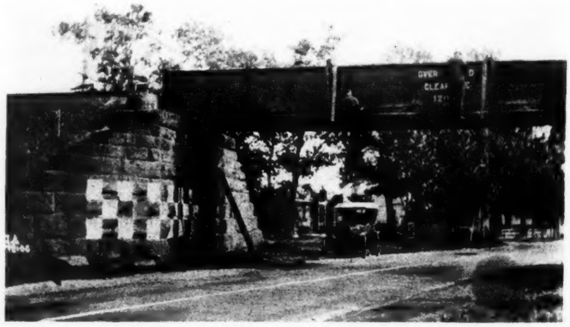
About 200 stringers in five four-track main-line bridges on the Pennsylvania, in the vicinity of New Brunswick, N. J., were repaired and strengthened by this method. Here, where 6-in. by 4-in. by 1/2-in. top flange angles were giving trouble, 3/8-in. gussets were used. All of the repair work on these stringers was carried out without interruption to traffic and without staging, and it is estimated that the method used, resulted in a saving of approximately $25,000 over the cost of renewing the stringers.

Stringer Connections Strengthened

Another effective use of welding in bridge repair work on the Pennsylvania, where large savings were effected, was in connection with the repair of floor-beam-stringer connections on a six-span, two-track, open-deck through truss bridge just west of Lock Haven, Pa. Here, cracks had developed in the fillets of the connection angles, usually near both their tops and the bottoms.

In making repair, the method followed was similar to that described previously in repairing the cracks in the upper flange angles of stringers, but in this work it was necessary to extend the fillet repair only throughout a distance of about a foot at the top and bottom of the angles. This was done on all angles, whether cracked or not, to insure uniform strength in all of them.

To increase the strength of the connections between the stringers and floor beams in these bridges, the connection angles were all fillet-welded to the filler plates beneath them, and the filler plates were then welded along their edges to the webs of the floor beams and stringers. This resulted in eight lines of welding at each stringer connection, in addition to the repair of the connection angles. Altogether, approximately 1,000 lin. ft. of welding was done in this six-span bridge in repairing connection angles, and about 6,000 lin. ft. of fillet welds were made in strengthening the old riveted stringer-



Increasing the Top and Bottom Flange Sections of the Girders of a Bridge on the Long Island, Using the Welding Method

floor-beam connections. It is estimated that to have effected the same degree of repair by renewing the connection angles and doing such other work as would have been necessary in this case, would have cost approximately four times as much as the repairs effected by the welding method.

Another class of repairs to girders by welding has been carried out on about 11,000 ft. of the two and four-track steel viaduct of the Long Island, on Atlantic avenue, Brooklyn, between Nostrand and Ralph avenues and between East New York and Atkins avenues. Here, the outstanding legs of the bottom flange angles of the

outside stringers had become worn and corroded quite seriously at the expansion bearings. This condition, which extended only two to three feet from the ends of the stringers, was the result of moisture and the slight weaving action of the expansion ends of the stringers on the column brackets.

In making repairs, the oustanding legs of the angles, together with a strip of the web slightly deeper than the thickness of the flange angles, were cut off by an acetylene torch, the cuts being made from both sides of the web and extending throughout the length of the weakened portions of the flanges. The cut in each side of a stringer was made downward on an angle of about 45 deg. to the horizontal, so that the faces of the cuts met in a line through the center line of the web. Following the cut, a new section of 5/8-in. steel plate, equivalent in width to the original bottom flange, was laid up under the cut section of the stringer and welded in place. The welding was done on top, on both sides of the web, and the weld metal was made to fill the "V" notch on each side formed by the bevel cut of the old steel and the top face of the repair plate. The repaired section thus resembled the old section in shape, and was at least as strong as the original section when new because of the increased thickness of new steel added. Some shoring of the individual girders was necessary during repairs, but traffic was not interfered with at any time.

Columns Strengthened and Repaired

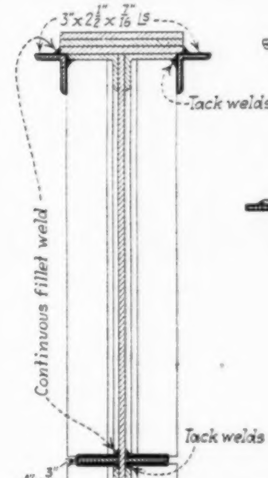
In addition to the welding work which has been done on different types of girders, this method of repair and strengthening has been used in connection with the strenthening and repair of the columns of steel viaducts. On the Erie, in strengthening two viaducts, one 730 ft. in length at Millerton, Pa., and the other 487 ft. in length at Trowbridge, Pa., all of the tower columns were given additional strength by the addition of reinforcing plates.

The original columns were of a box section consisting of two web plates and four angles, with a cover plate on the outside face and latticing on the inside face. In the strengthening work, a continuous reinforcing plate was laid between lines of rivets on the cover plate and was fillet-welded in place to the cover plate, and the latticing was burned off and replaced by a plate, wider than the original column section, fillet-welded to the inside angles of the columns. All holes in the inside angles, resulting from the removal of the latticing, were sealed by welding through them to the reinforcing plate. (See Fig. 3.)

On the Pennsylvania, at Jersey City, N. J., some effective work was done in connection with the repair of the bases of about 30 of the columns under its long multiple-track viaduct approach to Exchange Place station. Here, owing to settlement of the column foundations, amounting to as much as two to three inches in some cases, wooden shims had been driven under the base plates to restore the columns to their proper level. While this had proved effective temporarily, the shims caused the base plates to curl up on the edges and reduced the security with which the columns were seated.

In repairing this condition, the deck of the structure was supported on temporary timber posts at each column bent, and the column bases were completely rebuilt to the proper level. This necessitated the addition of new base plates, stiffening plates, webs, fins and anchor bolts, all of which were fillet-welded together into a rigid unit. Corrosion had also contributed to the poor condition of the column bases, but with all joints sealed by welds in the rebuilt bases, it is felt that this will not be of so much importance in the future.

The general feeling among those roads which have adopted or which have utilized to any extent the arc welding method in bridge repair or strengthening, is that this method has become thoroughly established and will make possible large economies in a considerable range of work. There is some difference of opinion as to where the line should be drawn in the use of the method, and, apparently, some difference in the degree of confidence placed in the actual welds themselves. However, it should be noted that in no case in connection with any of the work described has a serious failure occurred, and in only a few isolated cases have any of the individual welds proved defective or failed under stress. None of the roads mentioned in this article makes any allowance for the strength of butt welds in tension, and the stress



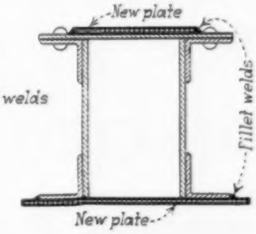


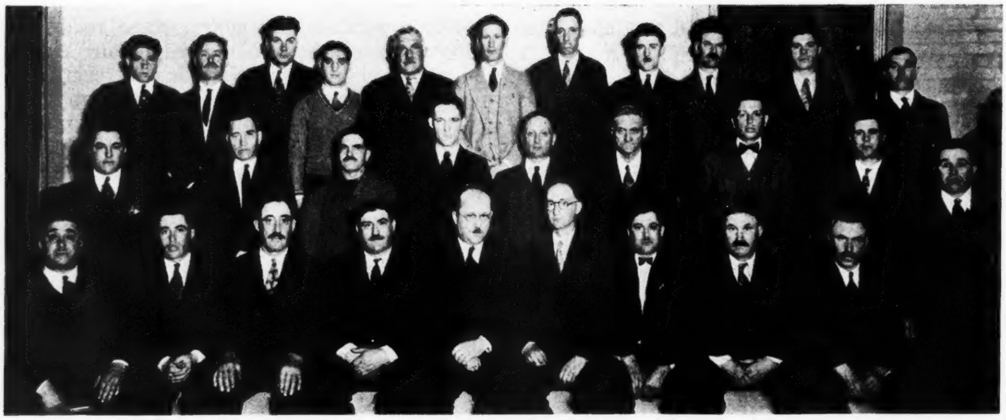
Fig. 3. (Above). Increasing the Sectional Area of Viaduct Columns by the Addition of Cover Plates

Fig. 2. (Left). An Unusual Method of Increasing the Section Area of Girder Flanges

per lineal inch of fillet weld allowed on the different roads ranges from about 2,650 lb. to 3,000 lb. in the case of 3/8-in. welds, and from about 3,540 lb. to 4,000 lb. in the case of 1/2-in. welds.

The principle advantage of the welding method lies in the greater economy in attaching new material to old members, compared with the expensive drilling of holes or backing out of old rivets to permit the application of new steel by means of rivets. Welding also affords a much simpler and cheaper means of reinforcing inadequate riveting than that of driving additional rivets in drilled holes. In addition, welding has the advantage that it does not involve the temporary weaking of members which is occasioned by the removal of old rivets to permit the riveting on of added material, and, furthermore, except in the case of eye-bars, the original members are maintained intact, so that the strength of the repaired bridge is certainly equal to or greater than what it was prior to the application of the welding material.

All of the work described in this article, with one or two exceptions where the railroads carried out some of the work with their own forces, has been done under contract. The equipment and force employed on the different jobs, as well as the methods, varied widely with the character and extent of the work and the speed with which it was desired that the work be completed. Ordinarily, the number of welding units employed varied from one to eight, and the number of men in the repair or strengthening force ranged from 2 to 25 men, including the welders and the men engaged in cleaning and painting work.



Photograph Taken at One of the Recent Foremen Debates—Oscar Surprenant, Roadmaster, and H. B. Bachrach, Supervisor, Are Seated in the Front Row, Fifth and Sixth, Respectively, From the Left

Foremen's Debates Create Much Interest

Innovation on the Delaware & Hudson has unusual grip on men—Many practical questions argued with mutual benefit

SIX months ago on Subdivision E of the Delaware & Hudson there was started a program of regular debates among the section foremen, covering a wide range of questions of particular interest to these men in their work. The results which are accruing among the men in the way of interest and educational value, not to mention the intangible benefits to the railroad, are far exceeding any heretofore realized through other forms of meetings. More than 25 debates have been held up to the present time, with from 8 to 10 debaters on each side and an attendance ranging from 25 to 65, exclusive of guests from other than the track department.

For a number of years the supervisory officers of Subdivision E have manifested a keen interest in the well-being of their foremen, not alone because of their interest in the men themselves, although that has been an important factor, but also because of the value to the subdivision and to the company through increased output and more efficient work, brought about by greater contentment and a higher standard of education among the men. Until recently, the oustanding educational effort on the subdivision, both in a general way and with regard to specific phases of railway work, has been applied through periodic meetings at which papers were read or talks were made by supervisory officers. These meetings were of more or less interest and value, but they did not awaken the enthusiasm or secure the results that the roadmaster thought were possible among his men. As a result, various innovations were tried to increase the interest of the men, and finally the idea of conducting debates was considered. With some degree of skepticism and uncertainty among those to whom the idea was broached, the first debate, on the subject, "It is better to promote 'Safety First' through example than through teaching," was entered into.

The idea of formal debates was new to the men, but apparently not the art or ability to argue. Furthermore, as they were fully acquainted with the subjects to be discussed at the different meetings, or had definitely formed ideas on them, they manifested no small degree of self confidence while presenting their arguments. Some of the men showed signs of uneasiness on their feet during the first debate due in part to the novelty of talking at length before so many men, and in even greater measure to the presence of a number of guests of higher rank, but even this was only temporary. Many were given an opportunity to speak at this debate whereas few had had such an opportunity at the usual foremen's meetings, and, as a result, a general interest was aroused which created a demand for subsequent debates. At the present time, the debates have become an established institution, with a sustained interest which carries them along from one meeting to the next. Many of the men, diffident at first, have become capable extemporaneous speakers and have added largely to their knowledge and abilities.

Altogether, there are 25 foremen on Subdivision E, which has its headquarters at Schenectady, N. Y. Many nationalities are represented among these men, but the majority are Italians or Americans of Italian parentage. Some of the older men, because of lack of opportunity, have difficulty in reading and writing the English language, but not in understanding it, and in only a few cases in speaking it clearly.

Attractive Programs Arranged

The debates are held two or three times each month in one of the larger offices in the freight house at Schenectady, that city being selected for the meetings not only because it is the subdivision headquarters, but also because it is centrally located on the subdivision. In the rather spacious meeting room, benches are arranged around the side walls, facing the chairman of the meet-

ing and any guests who may be present. The debates are always held on week nights in accordance with previous announcements, and begin promptly at 7:30 p. m. All of the men attending the debates come on their own time, and without urging or coercion, some of them driving as far as 20 miles in their own automobiles.

Preceding the debates, from 8 to 10 foremen, previously designated in order that they can make proper preparation, present short items on current railway maintenance matters, usually reading from self-prepared manuscripts or, we learn, from the editorial and questions and answers pages of *Railway Engineering and Maintenance*. Following this opening feature of the program, one or more supervisory officers in attendance as guests are asked to make a few terse remarks to whet the spirit of the foremen, and especially of those who are to debate. This is followed by the reading of the question to be considered, by the roadmaster, acting as chairman of the meeting, who calls on the different debaters in a predetermined order, alternating those from the affirmative and negative sides. To insure a proper understanding of the question to be discussed, a letter of explanation, giving typical arguments, is sent by the roadmaster to each of the debaters well in advance of the meeting.

There are usually six speakers and five alternates, or substitutes, on each side, and each speaker is allowed as much time as he desires, although this rarely exceeds 8 or 10 min. The only restriction on the time allowed is that it is a fixed rule that the meeting shall adjourn promptly at 9:30 p. m. to permit the men to reach their homes at a reasonable hour. After the last debater has presented his arguments, the judges, who include the roadmaster and his supervisor, and any qualified guests who may have been appointed by the chairman, pass their verdicts to the chairman who reads the result.

Interesting Questions Discussed

An idea of the questions discussed by the foreman will be gained from the following subjects, which are typical of those which have been taken up to date:

"That it is better to give a general lining to main tracks every spring and fall than to try to maintain alinement as work is performed during the year."

"That the spacing of ties should be undertaken out-of-face the same year that rail is laid, rather than attempt to space them only when and where track is raised."

"That more and better work can be done by working each gang on its own section alone, than can be done by doubling section gangs together."

"That maintaining uniform forces throughout the year is more economical than reducing forces in the winter and hiring extra men during the summer season."

"That it is more economical to build new switches or to rebuild existing switches over the entire subdivision with the extra gang foreman or another foreman well qualified in that phase of work in charge, than it is to have each foreman do his own switch work with the help of his neighboring sections."

"That it is more economical to ditch a cut on one side of the track and drain the opposite side by means of cross drains, than it is to ditch both sides."

"That greater benefit is derived by laying out 130-lb. rail out-of-face from one end of a subdivision, including both tracks in double-track territory, and continuing the next year where we left off the previous year, than is possible through laying the rail first in locations where the wear and tear are the greatest, before filling in the gaps between these points."

During the debate on the last subject mentioned, the proper place or places to lay each years rail allotment, which was typical of many of the other debates, 76 arguments, covering either new points or amplifying points already made, were presented by the debaters, who argued the subject with a marked degree of intelligence and spirit. The negative side was awarded the decision in this debate, but the judges agreed that the manner of presentation was equally effective on both sides.

The success which has attended the foreman debates is the result of many factors, among which are the character of the subjects discussed, the presence of a few better educated men among the foremen who are willing to take the initiative, the general high morale among the foremen on the subdivision, the central point of meeting and the reasonable closing hour, and, of large importance, the enthusiastic and sympathetic support given to the debates by the roadmaster of the subdivision, Oscar Surprenant, and his supervisor, H. B. Bachrach.

Wood Preservation Slumps in 1931—Ties Stable

THE total quantity of timber given preservative treatment in the United States in 1931 decreased 29.8 per cent, while the quantity of crossties treated dropped only 23.1 per cent, thus raising the latter classification to 62.5 per cent of the total of all timber treated, as compared with 57 per cent in 1930. These facts, together with the data given below, are taken from the annual statistical report on wood preservation in the United States for 1931, which was compiled by R. K. Helphenstine, Jr., forest service, United States Department of Agriculture, in co-operation with the American Wood-Preservers' Association.

Last year preservative treatment was applied to a total of 233,334,302 cu. ft. of wood, which was a reduction of 98,984,275 cu. ft. as compared with the figure for 1930, while the treatment of crossties decreased 43,967,829 cu. ft. to a total of 145,833,492 cu. ft. The quantity of switch ties treated last year, 10,897,532 cu. ft., represented a decrease of 3,725,181 cu. ft., or 25.5 per cent, as compared with 1930. Taken together, the crossties and switch ties treated comprised 67.2 per cent of the total amount of timber treated last year, while in the

Crossties Treated, by Kinds of Wood and Kinds of Preservative—1931
Number of Crossties

Kind of Wood	Treated with creosote (1)	Treated with creosote-petroleum (2)	Treated with zinc creosote (3)	Treated with zinc chloride	Treated with miscellaneous preservative	Total	Per Cent
Oak	16,139,594	1,868,616	635,459	801,571	9,184	19,454,424	40.0
Southern pine	8,012,660	1,131,603	105,812	374,983	260	9,625,318	19.8
Douglas fir	73,500	3,027,049	336	1,043,755	4,778	4,149,418	8.5
Gum	1,981,805	302,046	559,043	25,989	.....	2,868,883	5.9
Ponderosa pine	....	2,216,289	335,825	....	1,014	2,553,128	5.0
Beech	1,321,321	537,792	....	548,830	.....	2,407,943	4.9
Birch	777,046	688,905	....	355,321	.....	1,821,272	3.8
Maple	1,038,518	465,886	....	252,929	.....	1,757,333	3.6
Lodgepole pine	....	1,255,663	51,875	209,693	.....	1,517,231	3.0
Tamarack	19,187	168,337	....	206,441	.....	393,965	.8
Elm	141,969	61,912	....	51,351	.....	255,232	.5
Hemlock	....	5,965	....	107,549	.....	113,514	.2
Miscellaneous	1,051,099	473,934	....	168,470	.....	1,693,503	4.0
Total	30,556,699	12,203,997	1,688,350	4,146,882	15,236	48,611,164	
Per cent of total	62.9	25.0	3.0	8.5	0.6		100.0

(1) Includes distillate coal-tar creosote, creosote coal-tar solution, refined water-gas tar and water-gas tar solution.
(2) Includes distillate coal-tar creosote, creosote coal-tar solution, refined water-gas tar and water-gas tar solution in mixture with petroleum.
(3) Includes distillate coal-tar creosote, creosote coal-tar solution, refined water-gas tar and water-gas tar solution in mixture with zinc chloride.

previous year these classifications amounted to 62 per cent of the total. Including all timber, more than 80 per cent of the amount treated was for the railways.

The quantity of piles subjected to preservative treatment last year decreased 7,256,059 lin. ft., or 28.8 per-cent, to 17,920,864 lin. ft., while the reduction in the number of poles treated, which was 2,005,232 or 46.8 per cent, brought the figure for this classification to 2,270,799 poles. All of the eight classes of material treated last year showed declines as compared with 1930,

Wood Preservation, 1909-1931

Together with consumption of creosote and zinc chloride

Year	Total Material Treated, Cu. Ft.	Number of Crossties Treated	Creosote Used, Gal.	Zinc Chloride Used, Lb.
1909....	75,946,419	20,693,012	51,426,212	16,215,107
1910....	100,074,144	26,155,677	63,266,271	16,802,532
1911....	111,524,563	28,394,140	73,027,335	16,359,797
1912....	125,931,056	32,394,336	83,666,490	20,751,711
1913....	153,613,888	40,260,416	108,378,359	26,466,803
1914....	159,582,639	43,846,987	79,334,606	27,212,259
1915....	140,858,963	37,085,585	80,859,442	33,269,604
1916....	150,522,982	37,469,368	90,404,749	26,746,577
1917....	137,338,586	33,459,470	75,541,737	26,444,689
1918....	122,612,890	30,609,209	52,776,386	31,101,111
1919....	146,060,994	37,567,247	65,556,247	43,483,134
1920....	173,309,505	44,987,532	68,757,508	49,717,929
1921....	201,643,228	55,383,515	76,513,279	51,375,360
1922....	166,620,347	41,316,474	86,321,389	29,868,639
1923....	224,375,468	53,610,175	127,417,305	28,830,817
1924....	268,583,235	62,632,710	157,305,358	33,208,675
1925....	274,474,538	62,563,911	167,642,790	26,378,658
1926....	289,322,079	62,654,538	185,733,180	24,777,020
1927....	345,685,804	74,231,840	219,778,430	22,162,718
1928....	335,920,379	70,114,405	220,478,409	23,524,340
1929....	362,009,047	71,023,103	226,374,227	19,848,813
1930....	332,318,577	63,267,107	213,904,421	13,921,894
1931....	233,334,302	48,611,164	155,437,247	10,323,443

ranging from 12.6 per cent for construction timbers to about 75 per cent each for crossarms and wood blocks.

Of the total number of crossties treated, which was 48,611,164, or 14,655,943 less than in 1930, nearly 63 per cent were treated with creosote, 25 per cent with creosote-petroleum mixtures, 8.5 per cent with zinc-chloride and 3 per cent with creosote in mixture with zinc chloride.

As in past years, oak ties ranked first from the standpoint of the number treated, which was 19,454,424, or 40 per cent of the total. Southern pine came second with 19.8 per cent and Douglas fir was third with 8.5 per cent, followed in succession by gum, ponderosa pine, beech, birch, maple, lodgepole pine, tamarack, elm and hemlock.

With respect to switch ties, of which 130,770,378 ft. b. m. were treated, or 44,702,174 ft. b. m. less than in 1930, oak ties comprised 56.3 per cent of the total, Southern pine 21.9 per cent and Douglas fir 10.1.

At the close of 1931 the number of treating plants in the United States totaled 216, of which 204 were in active operation and 12 were idle, while 3 plants were abandoned. In spite of this, however, four new plants were constructed during the year and placed in operation. Of the active plants, 134 were of the pressure-cylinder type, 53 were non-pressure (open-tank) plants, and 17 were equipped for both pressure and non-pressure treatment.

Statement of Material Treated by Classes (Cu. Ft.)

Class	1931	1930	Decrease	Per Cent
Crossties	145,833,492	189,801,321	43,967,829	23.1
Switch Ties	10,897,532	14,622,713	3,725,181	25.5
Piles	12,119,880	17,027,153	4,907,273	28.8
Poles	39,966,062	75,258,146	35,292,084	46.8
Wood Blocks	1,256,567	5,012,445	3,755,878	74.9
Crossarms	319,625	1,299,246	979,621	75.4
Construction Timber..	16,624,072	19,013,369	2,389,297	12.6
Miscellaneous Material	6,317,072	10,284,184	3,967,112	38.6
Total	233,334,302	332,318,577	98,984,275	29.8

The creosote consumed in the preservation of wood in 1931 amounted to 155,437,247 gal., which was 27 per cent below the quantity reported for 1930, while the amount of zinc chloride used dropped to 10,323,443 lb., which was 3,598,451 lb., or 26 per cent, under the previous year. The consumption of miscellaneous salts and liquids suffered to even a greater extent, the quantity of the former used, 958,285 lb., being a reduction of 812,640 lb., or 45.9 per cent, below 1930, while the consumption of the latter was 120,625 gal., a reduction of 82,265 gal., or 40.6 per cent under the preceding year.

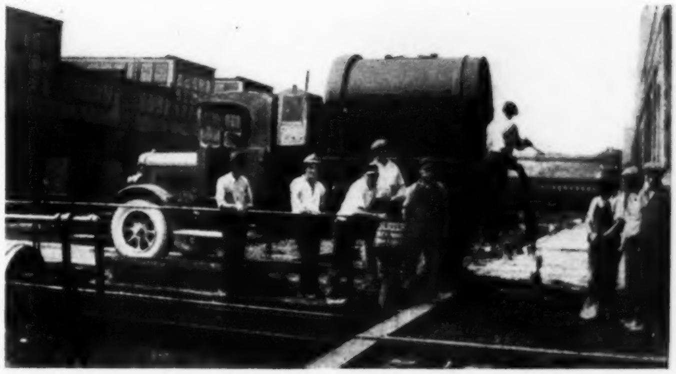
Treatment of Miscellaneous Materials (Ft. B.M.)

	1931	1930	1929	1928
Lumber	43,119,020	76,244,055	87,972,030	64,426,979
Fence Posts ...	13,468,058	17,843,001	10,904,180	7,272,422
Tie Plugs	1,149,058	1,779,215	2,018,147	1,747,026
Crossing Plank	2,248,946	2,552,370	273,588	1,460,463

J. A. Doyle (at the left), Bridge and Building Master of the Susquehanna Division of the Delaware & Hudson, With a Group of His Foremen and Other B. & B. Men Photographed at a Recent Safety Meeting

Ready-Mixed Concrete Finds Place in B. & B. Work

New York Central utilizes it to good advantage on jobs involving paving and building foundation work



One of the Three-Yard Trucks Dumping Directly Into the Paving Forms From the Transfer Table at the Shops

THAT the practice of purchasing concrete already mixed is finding its way into railroad work and is proving practical and economical under certain circumstances at least, is demonstrated in certain work which has been done on the New York Central at Albany, N. Y., where "ready-mixed" or "transit mix" concrete was used. The work in question, which included the laying of approximately 3,000 sq. yd. of roadway and the construction of the foundation and ground floor of a relatively small building, was not large, involving the placing of a total of only about 280 yd. of concrete, but it was of sufficient size and character to demonstrate the advantages of the method used under the circumstances.

Paving Job Presented Difficulties

The paving work was done within the area of the company's car shops at West Albany, N. Y., where certain stretches of truckingways or narrow-gage roadways, used mainly by electric tractors and trailers in carrying materials from shop to shop, required renewal. These sections of roadway, which had been paved with planking and which were from 5 to 11 ft. wide, were scattered over a considerable area and, in most cases, were located within congested spaces between and about buildings and tracks.

Having decided to repave the roadways with concrete, consideration as to how this could be done to the best advantage led to the conclusion to use ready-mixed concrete. In the first place, the congestion of facilities within the shop area did not afford room for setting up a concrete mixer and for the storage of concrete materials directly at the site of the work. Furthermore, to mix concrete on the site meant that the cement and aggregates would have to be trucked or wheeled from cars spotted some distance away, and then, that the concrete would have to be conveyed in wheelbarrows or concrete carts to the points of pouring. It meant also that the work would be relatively slow and costly and would interfere to some extent with operations at the shops.

Having decided upon the use of ready-mixed concrete, the only work necessary preliminary to the actual placing of the concrete, was the preparation of the areas to receive it. This work involved the tearing up of the old plank pavement, the preparation of a 24-in. cinder subbase for the new pavement, and the overhauling of the track foundation at all track crossings.

When the work of removing the old roadway planking and the preparation of the new subbase were sufficiently advanced, the work of laying the new pavement was started, the ready-mixed concrete being received in three-yard batches in transit-mix trucks. The method of placing the concrete varied somewhat, of necessity, because of the congestion of facilities about the shops. Where it was impossible to move the concrete truck directly alongside the work, it was driven as close as possible, usually within 75 ft., and discharged its load into a large mortar box about 14 ft. long, 9 ft. wide and 20 in. deep, made of 2-in. plank.

From this box the concrete was shoveled into wheelbarrows, by means of which it was moved to the paving forms. No attempt was made to back the delivery truck over the prepared cinder pavement base so that the concrete could be dumped directly into the forms, because of the damage which would have resulted to both the base and the forms.

Minimum of Handling on Much of Work

Where the roadway was paralleled by an adjacent track and it was not practical to drive the delivery truck out on to the track, two push cars, with mortar boxes built on them, were used to distribute the concrete. In these cases the truck discharged its load directly into the mortar boxes and the cars were then pushed to the work, where the concrete was shoveled into the forms.

In constructing one section of roadway about 350 ft. long, even this small amount of rehandling was avoided. This occurred at a point where the roadway paralleled one side of a transfer table pit. Here, the delivery truck was backed on to the table and the table moved as necessary to permit pouring directly from the truck into the forms, in the exact quantity needed.

All of the work described was handled by a force consisting of a foreman and 10 men, which included a mason, a carpenter and a carpenter's helper, and seven laborers. The concrete was delivered at scheduled intervals of from 15 to 40 min., the shorter intervals applying when the concrete was poured directly into the forms and the longer intervals being arranged for where it was necessary to use wheelbarrows or push cars.

There is nothing unusual about the pavement itself this being 6 in. thick of 1:2:4 concrete, with the surface floated up from the main body of the mixture, but there are features of interest concerning the track crossings where special precautions were taken to insure smoothness and permanence. In the first place, a new clean stone foundation, thoroughly tamped, was provided. This was covered with several inches of clean cinders to about the mid-height of the ties; a layer of fine cinders were also spread over the tops of the ties. Flangeways were provided in all cases by means of suitably shaped iron strips or lengths of scrap rail turned on edge, and 2-in. by 4-in. timber separator strips were placed along the outside of the head of each track rail to prevent direct contact of the concrete with the rails.

The concrete slabs between the track rails were cast as a unit from flangeway to flangeway and made not only to surround the tops of the ties down to the cinder sub-base between them, but were all reinforced on their bottom sides by ⅝-in. steel rods, spaced 6 in. apart.

Ready-Mixed Concrete Speeded Building Job

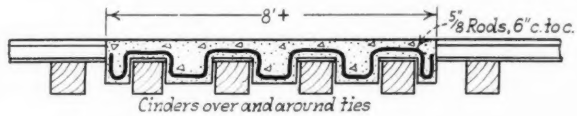
The paving work was done so satisfactorily and economically that, some time later, when rapid construction was required in erecting a one-story building for mail transfer purposes directly behind the Union passenger station at Albany, it was decided to use ready-mixed concrete in the foundation and floor. The building is a brick structure, 127½ ft. long by 27½ ft. wide, with a board roof on steel I-beams, protected by five-ply built-up roofing. There is no basement in the building, and the foundation wall on three sides, which is 12 in. thick and 7 ft. high over a continuous footing 24 in. by 10 in. in section, extends to a height of 3 ft. 9 in. above the

Ten Men Laid the Paving at Approximately 50 Per Cent of the Originally Estimated Cost

ground-floor level. On the rear side of the building, throughout its full length of 127½ ft., the foundation rests on an old stone masonry retaining wall, at ground level, so that no excavation was necessary in its construction. The floor of the building, which is of concrete on a cinder foundation, is 6 in. thick and extends along the front of the building to form a track-level platform, 10 to 15 ft. wide, with an 18-in. concrete curb along its outer edge to separate it from an adjacent track.

With less than a month in which to construct the building the use of ready-mixed concrete proved most helpful, not only in speeding up the actual placing, but also in avoiding the delay in assembling the equipment and materials. Furthermore, the congestion of facilities at and near the site all but precluded the possibility of setting up even a small mixing plant within a reasonable distance from the work. That a saving in the time of construction was effected through the use of ready-mixed concrete is seen in the fact that the entire building was completed for occupancy in 21 working days.

As soon as the trench was dug for the front foundation wall and the forms were set up for the footing, depositing began, the three-yard mixing and delivery trucks depositing the concrete directly into the forms by straddling the trench. This method was employed also in constructing the front wall to its full height above the ground level, it being necessary to lay elevated wheel-



Section of the Concrete Roadway at Track Crossings

ways of 3-in. by 10-in. planking and old timbers on each side of the trench to do this. Because of the position of the rear of the building over an existing retaining wall several feet in height, the foundation wall could not be deposited directly from the trucks. Here, therefore, it was necessary to wheel the concrete into place in wheelbarrows.

Because of the limited length of the end walls, no attempt was made to pour them and their footings directly from the trucks. In these cases the trucks dumped the concrete near the ends of the trenches, from which points it was readily shoveled into the forms.

In laying the floor and platform of the building, the trucks were backed into the building or over the platform area, and dumped the concrete directly into place. The rapidity with which this particular phase of the work was done is seen in the fact that the entire floor and platform area, approximately 3,200 sq. ft., was poured in approximately 24 hours.

Use Was Economical and Advantageous

All of the concrete used in both of the jobs described was secured from the ready-mixed concrete plant of the Albany Sand & Gravel Company, which is located within about two miles from each job. At this plant, the cement and dry aggregates, with the water in a separate container, and all in accordance with the specifications of the railroad, were loaded into the specially designed concrete trucks from overhead bins or containers. The trips of the trucks were scheduled carefully and actual mixing of the concrete was begun enroute at a predetermined point so that it would not be held in the plastic state too long, and yet so that it would be mixed thoroughly when the work was reached.

While it is recognized that local conditions have a large bearing upon the advisability and economy of purchasing concrete already mixed, it is known that the use of it in the cases cited was highly effective and economical. In the first place, the cost of the concrete in place was unusually low. In the case of the roadways at the West Albany shops, the concrete was laid at a total cost of $7.93 a cu. yd.; at the mail building it was placed in the floor and platform at a cost of $8.05 a cu. yd., while the cost of the concrete in place in the foundation walls was $8.58 a yard. These costs were approximately 50 per cent of the estimated costs of mixing the concrete on the two jobs in the usual manner.

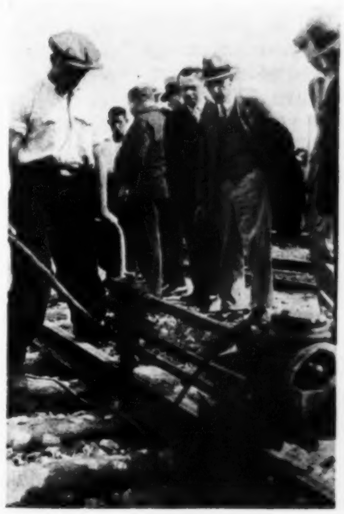
This work was done by the maintenance of way department under the immediate supervision of K. L. Miner, assistant supervisor of bridges and buildings.

Is France Ahead in Track Practices?

Review of standards of design and maintenance shows many variations in comparison with this country

By SIR GORDON HEARN
British Permanent Way Institute, London, England

RAILWAY men in the United States naturally are interested chiefly in their own problems and practices, but a review of conditions obtained abroad offers a means of comparison that is both interesting and instructive. During a recent visit to France in connection with the annual convention of the British Permanent Way Institute I obtained a considerable amount of practical information regarding permanent way practices on the French railways which, for the above reason, should be of interest to track men in other parts of the world. While some of the information presented herein originated at the convention, much of it was obtained through the patience and courtesy of Mons. Grosjean of the Est Railway, who supervises the design of material for that road.



In the Top View Is Shown a Two-Man Pneumatic Tie Tamping Outfit of the Type Employed in France, While the Operation of the Collet Eight-Man Machine is Demonstrated at the Lower Right. The Third View Shows a Screw Spike Driving Machine. All Three Illustrations Were Obtained on the Paris, Lyon & Mediterranean

In general the gage of the French railways measures 1.435 meters (4 ft. 8½ in.), although in certain portions of the country it is ½ in. wider. Practically all the main lines are double-tracked, in which the "six-foot way" between rails is two meters (6 ft. 7 in.), the distance between the centers of the tracks being about 11 ft. 8½ in.

The track centers are not increased on curves, but the ends of the coaches are tapered. The maximum width of the cars is 9 ft. 8 in. and warning signs in English, French and German inside the coaches caution passengers against the danger of leaning out of the windows.

The speed of trains on curves is governed according to the following table:

Degree of Curvature	Speed	Degree of Curvature	Speed
2 deg. 10 min.	75 m.p.h.	5 deg. 49 min.	37 m.p.h.
2 29	69	6 59	31
2 55	62	8 41	25
3 29	56	11 42	19
4 22	47		

In fixing these speeds it was recognized that they may be exceeded by 10 per cent. The train conveying the main body of the Permanent Way convention to Paris attained a speed of 76 m.p.h. at one point.

The width of the embankment in double-track territory is 34 ft. 6 in., a wide bank being recognized as a factor that contributes toward stability and facilitates maintenance work. On curves the roadbed is sloped at the rate of 1 in 50 and is sometimes serrated or terraced as a means of economizing in the used of ballast. The maximum superelevation on curves permitted on the Est is 6 in., while on the Nord there is no fixed maximum, the superelevation sometimes being as high as 8 in.

The use of guard rails on curves is not common practice, but curves having a radius of 335 ft., the sharpest allowed for locomotives, are equipped with double guard rails providing a flangeway of 2 in. At points where it is unnecessary to use locomotives in the handling of cars, a minimum radius of curvature of 163 ft. is permitted.

The gage on curves is widened as follows:

Degree of Curve	Widening of Gage (Inches)
3 deg. 46 min. or flatter	None
3 deg. 47 min. to 4 deg. 42 min.	0.4
4 deg. 43 min. to 9 deg. 15 min.	0.8
Sharper curves	1.18

The latest 4-8-2 express locomotive on the Est has passed over a curve of 295 ft. radius with the gage widened only 1 in.

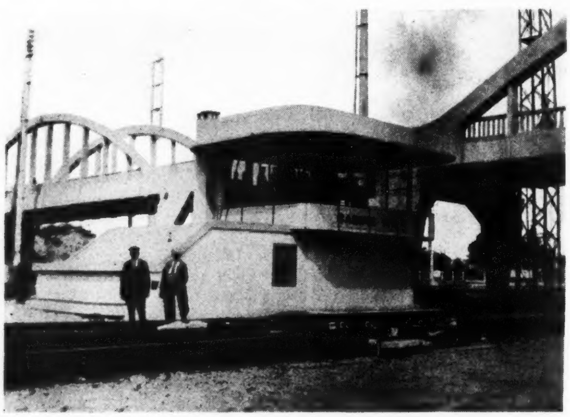
On high-speed tracks the length of transition or easement curves is calculated on the basis of 1,000 units for each unit of superelevation. With this system the length of the transition on a curve having a superelevation of 0.5 ft. would be 500 ft. The rate of run-out may be reduced but not below a ratio of 500 to 1. As in the United States, the cubic parabola forms the basis of the easement curves. With respect to vertical curves, however, the practice in the two countries varies, the circular curve with a radius of 3,281 ft. being used in France.

Ballast

The material considered as furnishing the best grade of ballast is broken quartzite. The standard depth of the ballast below the ties is 12 in., the lower half of which is composed of material of the larger sizes. The ballast section, which is level with the top of the ties, provides a 12-in. shoulder beyond the ends of the ties on each side.

Quarry screenings tamped or packed in place with shovels are used extensively as ballast. These screenings are stored along the right of way in bins, often of concrete, which are spaced about 500 ft. apart. From these bins the screenings are conveyed to the point of use in boxes, the quantity used to make any specified lift being a matter of judgment.

When making a raise in the track, the cribs are cleared completely of ballast, the tie is lifted and the screenings inserted. Only after the passage of a train or two can the result of the raise be determined, as the screenings become absorbed in the interstices of the coarser ballast. In the cost of using screenings, the labor of rehandling them from the bins to the point of use constitutes a considerable item. Through the use of picks or mechanical tie tampers, the low spot can be raised without completely clearing the cribs, and ballast can be tamped under the ties with little opportunity for settlement.



A Reinforced Concrete Switching Tower at a Classification Yard on the Nord Railway

Power Tamping Demonstrated

The mechanical tamping of ties was demonstrated by the Paris, Lyon & Mediterranean railway using two machines, the Collet and the Christiansen. The former operates eight tampers and has a range of operation with respect to the compressor of 500 ft. The tampers are hung from a small gantry crane mounted on small flanged wheels, thus facilitating their handling. With these tampers, the tie may be tamped simultaneously at four places on each side. A crew of 12 men using this equipment can average 492 ft. of track a day, while a maximum of 900 ft. has been attained. The gasoline consumption is 8.8 gal. for each 1,000 ties tamped. A telescopic sighting instrument for measuring irregularities in the surface of the track has been used in conjunction with this tamper. A mechanical screw-spike driver for tightening screw spikes is also used in connection with this equipment.

Using the Collet machine, 16 miles of track on the Nord were surfaced about 18 months ago and still retain a good surface. On this section the regular track force has been reduced from 11 men to 6. If it is assumed that the work of tamping the 16 miles required a labor output of 48 men-months and that it will be another 6 months before the track will require resurfacing, the labor employed in maintaining the section for two years will amount to 192 men-months, whereas, on the old basis of 11 men, 264 men-months would be expended in the same period.

The Christiansen is a smaller machine than the Collet, operating only two tampers. It rests on the ties outside the rails and, since it is sometimes lifted on untamped ties, is susceptible of damage from the wheels of passing trains. If both sides of the ties are tamped, the gasoline consumption is three times as great as with the larger machine, and the cost of repairs is also much higher. However, the equipment is lighter in weight than the Collet and requires only four men for its operation.

The force allotted for the maintenance of track is not extravagant—one man to 1½ miles of running track and one to three miles of sidings. Over a district of 550 track miles the track force totaled 516 men.

Ties of Excellent Quality

The French people are experts in forestry and wood preservation and, consequently, their ties are of excellent quality. It is estimated that their oak ties have an average life of 25 years, while the life of beech ties is 5 years longer, the span of life being determined by the loss of capacity to hold screw spikes. Obviously, a certain number fail in much less time. On observation the ties were found to contain longitudinal cracks although not nearly to the same extent as in softer woods.

The practice of renewing ties out-of-face during the laying of rail is favored, although the advantages claimed for this method are widely disputed. Creosote is used almost exclusively in the treatment of ties, the use of zinc sulphate having been abandoned in view of the increasing importance of track circuiting and the propensity of this chemical for conducting electricity. For the same reason steel and even reinforced-concrete ties are considered objectionable.

The number of ties used per mile in high-speed tracks is 2,680, while in secondary tracks 2,380 per mile are used. The spacing at the joints is only 16½ in. center to center, bridge joint bars, notched for the screw spikes, being commonly used. Six spikes are applied to each tie, two on one side and one on the other at each rail, the arrangement being reversed with alternate ties. No extra spikes are driven on curves.

Tie plates are not in common use, an old type with a small area being applied to some extent. Perhaps they will become necessary, however when the driving axle load is raised to 22 long tons, the axle load of the new 4-8-2 locomotive of the Est being only 18 tons.

The standard weight of rail used on the French railways is 92 lb. per yard, canted 1 in 20 on adzed rail

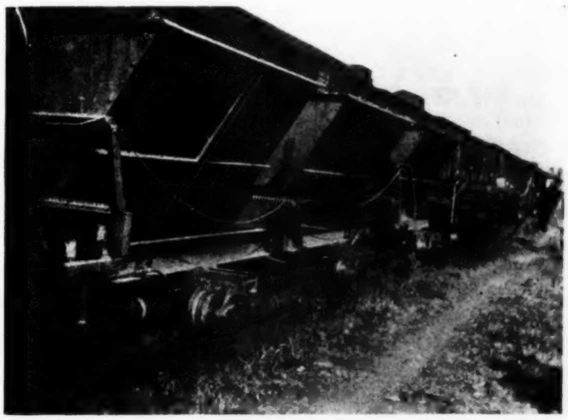
seats. Apparently there are no standard specifications for rail, but some analyses showed the following results:

Constituents	Range
Carbon	0.450—0.470
Manganese	0.900—1.030
Silicon	0.100—0.110
Phosphorus	0.070
Sulphur	0.030

The Sanberg sorbitic process of heat-treating rails has proved successful. Switch points are treated before being planed, since the planed parts are not subject to severe wear.

Standard Rail Is 59 Ft. Long

The generally adopted rail length is 18 meters, or slightly more than 59 ft., while there are some rails 24 meters (78 ft. 9 in.) in length. However, owing to the fear that they may buckle when subjected to high temperatures, rails of the latter length are not popular. Nevertheless, three 18-meter lengths, totaling 177 ft., have been welded together on the Nord, while rails totaling 490 ft. in length have also been welded. So far the Est welds rails in tunnels only, where the temperature range is small. In England the London & North Eastern Railway has recently laid bull-headed rails 90 ft. long having a calculated free expansion of 7/8 in., but, although they were laid with an expansion allowance of only 3/8 in., no trouble has occurred, so great is the grip through the keys to the chairs in which the rail is carried. In France, practice in allowing for expansion follows a thermometric table based on free expansion.



A Track Relaying Outfit Showing the Ballast Hopper Cars and Ties

The diameter of the track bolts is 0.95 in., that of the bolt holes in the joints is 1.11 in., and that of the holes in the rails is 1.26 in.

Apparently the building up of worn frogs by welding, which is practiced quite extensively in England, is not favored in France.

Methods of track construction and maintenance are such as to result in a large amount of "creep" on the French railways. Experiments with anti-creepers have been conducted but, since only two are applied to a rail, the results naturally have been disappointing. Where anti-creepers are used, about six ties are tied together to form an anchorage.

The limit of allowable rail wear on the Est is a reduction in the height of the 92-lb. section of 2/3 in., although on curves another rule, which takes side wear into consideration, is used to determine the wear. Rails with battered ends are cut and redrilled for use on branch lines, about 20 in. at each end being cut off.

Equipment for renewing track, consisting of a gasoline motor car as the power unit, four low rail gantries for carrying double (spliced) rail lengths, four ballast hopper cars and a low-sided truck for carrying fastenings, was demonstrated on the Paris, Lyon & Mediterranean. This equipment carried sufficient material for laying 650 ft. of track. By means of auxiliary wheels which run on channel irons, the motor car can be derailed and pushed to one side in about 6 or 7 minutes. While this equipment has its advantages when used on busy tracks, the material must be handled twice from the material train to point of use, which is a disadvantage.

Weed destruction with sodium chlorate was also demonstrated on the P. L. M. The strength of the solution used is about one part of chemical to four parts of water, although this is not of such importance as the necessity of applying the proper amount of chemical, which is about 3/4 ounce to 11 sq. ft. of vegetation. Around station yards and between platforms the solution is sprayed from a portable container while elsewhere it is applied from a tank car drawn by a locomotive.

Practices in Switch Design

A feature of particular interest is the switch design that is employed on the Est, which is regarded in France as one of the leaders in practice. The practice is to use a curved spring switch in which the gage line coincides with the curve throughout the length of the turnout, including the frog. In turnouts the flangeway of the guard rails is 2 in. wide and the gage is widened 7/8 in. throughout the lead to beyond the frog. In No. 20 turnouts the rails are canted at the rate of 1 in 20, while in all other turnouts no cant is applied to the rails.

In certain of the frogs with larger angles, the guard rail is raised 2 in. above the running rail, while in slip switches the guard rail is 2½ in. higher. In Great Britain the maximum number of crossing frog used in slip switches is the No. 8, although recent experiments have shown that, by raising the guard rail slightly, the number can safely be increased to 9. With this innovation, slip switches having a greater radius than heretofore possible may now be used. Ramping of the wing rails on turnout and crossing frogs to permit of greater wear before renewal or repair has been experimented with, but has been abandoned because of objections to the introduction of a change of profile in the rails. Since 1923, standard frogs have been cast in manganese steel.

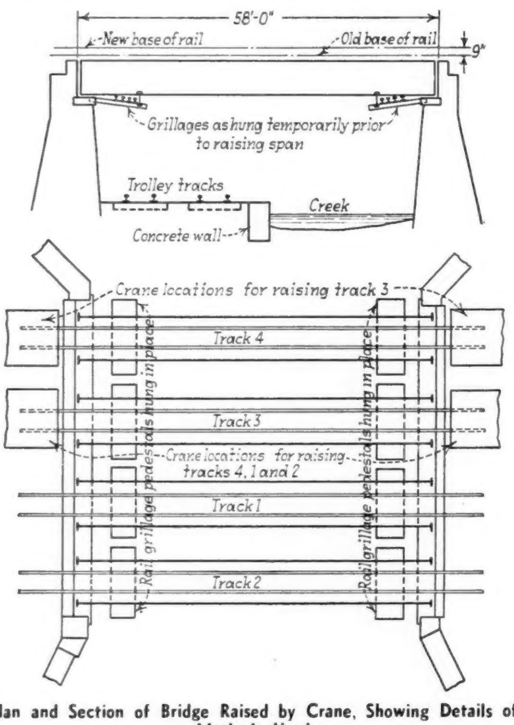
Ties used in turnouts are 10 or 12 in. wide and 6 in. deep, and are not interlaced as was the practice formerly when ties of standard size were used under switches. Prior to 1914 long steel ties were used under frogs, but since the introduction of track circuits these have been abandoned.

On the Grand Trunk Western Near Drayton Plains, Mich.

Crane Speeds Bridge Raising and Seat Renewal

USING a crane and scrap rail grillages, the New York Central made a relatively simple task of raising and renewing the seats for a four-track bridge on its main line near Schenectady, N. Y., which had otherwise promised to involve considerable difficulty and expense if done by the usual method of jacking, employing falsework. In fact, the average time required to raise each span 9 in., the height desired, and to place the new pedestals under each end, was only 19 min.

The bridge consisted of four deck girder spans, each 58 ft. long, which carried the main line over two trolley tracks and a small creek. The spans were carried on stone masonry abutments, with concrete caps which had begun to disintegrate. Since it was necessary to repair the caps, it was decided also to raise the spans to facilitate the work and to eliminate a sag in the track.



Plan and Section of Bridge Raised by Crane, Showing Details of Methods Used

Jacking Would Be Costly

To have attempted to raise the spans by jacking would have presented difficulties and have been costly. In the first place, because of the size and condition of the abutment caps, falsework would have been necessary to support the jacks. Secondly, because of the small clearance between the trolley tracks and one abutment, and the location of the creek alongside the other abutment, the construction of the falsework would have been most difficult. For these reasons it was decided to raise the spans with a crane of the steam type with a capacity for lifting 150 tons.

The tracks extend in a general east and west direction, and are numbered 2, 1, 3 and 4 from south to north. In carrying out the work, the crane, operating on Track 3, raised the spans on Tracks 1, 2 and 4, one end at a time, permitting the placing of new pedestal grillages on the old seats, and then moved to Track 4 to raise the span carrying Track 3. The track was not broken in this work, the crane lifting the track on the approaches as well as the spans, thereby simplifying the work of the track forces in speedily constructing runoffs.

The spans were supported on grillages of scrap rails, which were set accurately in position while the spans were held in the raised position by the crane, and which were afterward completely encased in concrete in the work of repairing and building up the old caps. The grillages consisted of four 10-ft. lengths of 127-lb. rail, laid side by side in upright position and bolted together by means of three ¾-in. bolts, with pipe separators between the rails. These grillages were built up on the ground directly beneath the bridge and were then raised by tackle to positions under the ends of each span, just clear of abutments, where they could be moved on to the old bridge seats when the spans were raised.

Interesting Feature

An interesting feature of this latter work was the manner in which the grillages were suspended temporarily beneath the spans to simplify their final placement. In this, each grillage was supported on two heavy steel angles, one at each end. One end of each angle was made to rest on the bridge seat while the other was suspended by a light cable from the bottom flange of the girder in such a manner that when the span was raised, the outer ends of the hanger angles were also raised. This raise was so adjusted that with a 12 or 15 in. working lift of the span end, the angles sloped downward toward the abutment cap, making it easy to slide the grillage downward over the angles, which were greased, into proper position on the cap.

To insure accurate level of the grillages under the span ends, heavy steel bearing plates were carefully placed on the abutment caps between spans, this work having been done for all spans prior to the actual work of raising. As a result of the preliminary arrangements made, therefore, it was only necessary to skid the grillages downward on to the new bearing plates while the crane held the span ends from 12 to 15 in. above their old positions. That this was a simple operation is seen in the fact that the average time required to raise each span, both ends, on the new grillages, was only 19 min.

The bridge force on this work included 10 bridge men, a crane operator and a foreman, while the track force included 2 foremen and about 20 men. Since the rails were not cut, the only work of the latter crew was to tamp up suitable runoffs for high speed operation.

With the bridges raised and the track up, the remaining work consisted only of building up the concrete bridge seat and coping. In this, which was done, of course, without interference with traffic, all disintegrated concrete was broken away, forms were set, and concrete was placed to the height of and completely surrounding the rail grillages. The result is a pair of completely restored bridge abutments, the work in connection with which cost only about one-half the cost of the falsework and jacking method of raising and which required only about one-fourth as much time.

This work was done by the maintenance of way department, under the direction of T. P. Soule, supervisor of bridges and buildings.

EMPLOYMENT DECLINES—As of the middle of April, employees on Class I railroads totaled 1,086,662 as compared with 1,096,506 in March, a reduction of 9,844.

What's the Answer?

Have you a question you would like to have someone answer?

Can you answer any of the questions listed in the box?

To Be Answered in September

1. What means, if any, should be employed to eliminate the possibility of damage to ties when operating weed burners?

2. What are the relative advantages of centrifugal and reciprocating pumps for pressure pumping? What are the limitations?

3. Where heavy rail and large tie plates are used, is there any disadvantage in mixing hardwood and softwood ties on tangents? On curves? If so, why?

4. Should impervious clay or porous materials, such as sand, gravel or locomotive cinders be used as back-filling next to retaining walls and bridge abutments? Why?

5. What type of ballast is most suitable for passing and other frequently used sidings? What should be the minimum depth of the ballast under the ties?

6. To what extent is it practical to use treated lumber in railway buildings?

7. To what extent is it practicable to substitute motor cars and trailers for work trains for section work? For extra gangs?

8. When placing a pipe culvert for a new embankment or to permit the filling of a bridge, how should the foundation be prepared?

Track Chisel or Torch?

What are the relative merits of the acetylene torch and the track chisel for cutting rails for yard use? Is the use of the torch permissible for cutting main track rails **?**

Recommends Using the Torch

By J. J. HESS
General Roadmaster, Great Northern, Seattle, Wash.

I consider that the acetylene torch far surpasses the track chisel for cutting rails in yards or for use on any other portion of the track. One of its particular advantages is that rails can be cut without the necessity of removing them from the track, which effects a great saving in both time and cost. The torch can also be used to make cuts close to the end of the rail, which is not always possible with the chisel, while there is less likelihood of damaging the rail.

So far as I am aware no bad effects have been discovered from cuts made with a torch. On the other hand, the burning of bolt holes is a dangerous practice, since the rail will almost invariably break as a result of the crystalization that occurs around the hole.

Does Not Recommend Using the Torch

By J. W. RIGGANS
Track Supervisor, Baltimore & Ohio, New Castle Junction, Pa.

I do not recommend the torch for cutting rails for either main-track or yard use, since it is my experience that rails so cut break after they are in service. Some rails will last as long as a year, some break sooner, but eventually all of them break as a result of this method of cutting.

Rails can be easily and quickly cut with a chisel, provided it is used to nick the edge of the base. After nicking, the rail is sprung and struck with a hammer when, as a rule, a rectangular break will occur.

In my opinion, the best method of cutting rails is by means of a hack saw. If the base is sawed to a depth of 1/4 to 1/2 in., depending on the section, and is then sprung and struck with a hammer, a clean break will be obtained. This method is also the safest. Many men have lost an eye when cutting rails with a chisel, from splinters which have become detached from the chisel under the blows of the maul. Serious injuries may also occur to other parts of the body from such splinters. In my opinion, the hack saw also offers the quickest method of cutting rails. I have timed this method of cutting and have found it possible to cut as many as 20 to 30 rails at the average rate of one cut in four minutes.

Considers Torch Better Than Chisel

By CHARLES WISE
Melrose Park, Ill.

In a yard where the operator is not compelled to lose too much time in going to and from the place where the cutting is to be done, I consider the acetylene torch superior to the track chisel. It requires about a minute and a half to cut a rail with the torch, whereas I have seen a whole gang consume several hours in an attempt to make a single cut with a chisel on a hot day.

Many times an old rail can be made usuable by cutting, say, 6 in. from the end, a difficult operation with a chisel, but perfectly feasible with the torch. Again, from the safety standpoint the torch is superior to the track chisel, since there is no danger of splinters causing personal injuries. In a yard where there is no regular welding

equipment, the chisel is probably cheaper and will get quicker results, but where there are many switches and many rails of odd lengths to be cut, including short cuts, it is better to do the work with a torch.

I see no reason why it is not permissible to cut main-track rails with a torch. I have been welding and cutting rails with the acetylene torch for many years and have never seen anything to indicate that this practice has a detrimental effect on the rails.

Prefers to Use the Track Chisel

By JOHN BEDNARZ

Section Foreman, Great Northern, Rugby, N. D.

No rail intended for use in the main track should ever be cut with the acetylene torch. This method damages the metal adjacent to the cut to the extent that it is certain to fail under heavy or high-speed traffic. As a result, not only is the life of the rail shortened, but the stage is set for an accident, the consequences of which cannot be foreseen. It may be permissible to cut with the torch rails which are to be used under slow moving traffic in yards, but my experience leads me to prefer the track chisel for cutting all rails. As far as it is possible to know, chisel-cut rails have the same potential life as uncut rails.

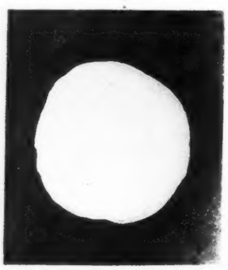
Torch Should Not Be Used

By M. D. BOWEN

Superintendent of Work Equipment and Welding, Chicago, Milwaukee, St. Paul & Pacific, Chicago

In my opinion it is a serious mistake to use the oxy-acetylene torch either to cut rails or to burn bolt holes in them. The effect on the metal surrounding or adjacent to the burned area is the same in either case so that a statement of what happens around a burned-out bolt hole will also apply to the surface at the end of a rail that has been cut with the torch.

By reference to the illustration it will be seen that there is a narrow but irregular band of metal around the hole that differs from the normal metal farther out, and that there is a crack visible at the lower right side,



How the Torch Affects a Zone Adjacent to the Burned Surface

which extends through this band and some distance into the normal metal. To bring this band into strong relief and emphasize the crack, which was not originally visible to the naked eye, the specimen was cleaned of slag and etched with ammonium persulphate. The photograph from which the illustration was made showed a magnification of three diameters.

It is evident from the photograph that the metal adjacent to the burned area has been definitely affected by the heat of the cutting torch. Microscopic examination shows that the metal in the band is what is known to metallurgists as martensite, which is very hard and very brittle. It is the same form of the metal which is used for very sharp-edged cutting tools, such as razor blades, but is not suitable for use where it is subject to stress or considerable vibration because of its brittleness. Martensite is so hard that it cannot be cut with a hack saw and can be filed only with difficulty.

When the cutting torch is used, the adjacent metal is heated to the point of fusion but the heat does not penetrate far below the surface. At the end of the burning operation, a very shallow zone is above the critical temperature of the steel and this mass is so small that the heat is dissipated rapidly, with the effect of sudden quenching from the fusion point. The result is that high internal stresses are set up and incipient cracks appear in the brittle metal, which soon progress to the normal metal. As a consequence, the rail may fail suddenly for no apparent reason.

It is my opinion, based on both experience and the analysis of the effect of the sudden heating to a high temperature and the quick cooling, that it is far safer to use a chisel to cut all rails and the track drill for boring the holes.

Electrolysis in Pipe Lines

What means, if any, can be employed to determine whether underground pipe lines are being subjected to electrolysis? If present, how can it be remedied ?

Electrical Drainage Is Best Remedy

By Supervisor of Electrical Operation

Underground pipe lines are particularly susceptible to electrolytic corrosion from stray currents originating in d-c. power systems. This action always occurs at the point where the current leaves the pipe line to enter the earth, and is almost directly proportional to the amount of current flowing. Water-distribution systems around shops that are operated by d-c. power and lines closed to electrified railways using this type of power are always open to suspicion and should be watched closely.

Electrolytic corrosion is easily identified by the typical grouping of the small pits, which are visible after the corroded metal is cleaned from the surface, at joints or along the length of the pipe, but in the latter case on one side only. The location of these groups depends on whether the general direction of the current is parallel with or lateral to the axis of the pipe line.

A simple test with a high-resistance voltmeter will verify the presence or absence of the suspected current. These tests, which should be made by the electrical department, should include readings between the pipe line and any independent pipe systems, buildings and other structures which are or contain good conductors. If an electrified traction line is involved, tests should also be made during the rush hours of the day, or a recording voltmeter can be used to obtain a continuous record. In addition, if current is detected, an earth-current meter will give valuable information as to the magnitude of the flow in the soil surrounding the pipe.

Electrical drainage provides the only satisfactory remedy. In some instances this can be obtained by connecting the pipe line to the negative bus of a nearby transformer or generator station or to the rails of the traction line by means of a copper cable. If this is not feasible, electrolysis can be reduced by burying sections of cast iron pipe in a good ground at intervals or at points where electrolysis is active, placing them well away from the pipe line on the side toward which the current is flowing. They should be well bonded to the pipe line.

Electrolysis Is More Common Than Realized

By Engineer of Water Service

Electrolytic corrosion is more common than is generally realized. Any pipe line that is located close to an electric railway which uses direct current propulsion, near a d-c. generating station or at points where direct current power is used with a grounded return, should be under suspicion with respect to electrolysis. I have in mind a reinforced-concrete building near a d-c. generating station which began to show evidence of widespread damage. Investigation showed that return current from a grounded distribution system was entering the pipe line and reaching the building and that both the pipe line and the reinforcing in the concrete were suffering severely from electrolysis.

Probably the simplest method of testing for electrolysis is to select suspected points and uncover several lengths of pipe, wash them thoroughly and inspect them for surface pitting. If electrolysis is present, the pitting will be grouped near a joint or on one side of the pipe throughout its length. Special attention should be given to leaded joints, since lead erodes much more rapidly than either cast iron or steel under the action of electrolysis.

If pitting of this character is discovered, or an additional check is desired where this investigation gives negative results, a high-resistance d-c. indicating voltmeter should be used to take readings between adjacent pipe lines, not connected with the one under test, buildings or other structures. If current is present, remedial action should be taken at once.

The most satisfactory remedy is to install a copper cable to connect the pipe line with the negative bus of the electric substation or generating plant. If this is not practicable in the case of an electric railway, the connection can be made to the running rails. Arrangements for testing the drain frequently should be made to insure that it is functioning properly.

Surprise Tests

Are surprise tests to detect unsafe practices and violation of instructions among maintenance men practicable and beneficial? If so, how and by whom should they be made **?**

They Are Both Ethical and Necessary

By G. H. WARFEL

Assistant to Vice-President Operation, Union Pacific, Omaha, Neb.

Some roadmasters and supervisors feel that surprise checks and secret observations savor too much of spying and eavesdropping. Yet is it more ethical to let rule violations and unsafe practices continue until someone is maimed for life or even killed, when the practice could have been detected and corrected by surprise checking?

On some of the best managed roads representatives of the employees, as well as the operating officers, have become fully convinced that surprise checks and secret observations are not only ethical but imperatively necessary to assure maximum safety to employees and the public. Violation of rules and similar taking of chances is almost, if not quite, as criminal as law violation, and often the results are more serious. The surest way for a roadmaster, a bridge supervisor or a division engineer to find out just how his men perform on the job is to watch them for a while from a vantage point when they do not know he is anywhere in the vicinity. He may notice practices which, if corrected, will save painful injuries to his men and much money for his company. Whether he finds them or not, the knowledge that he has adopted such methods will go far towards eradicating the things he desires to correct. That such methods are both practicable and beneficial seems hardly open to question.

Such checks should preferably be made by maintenance of way road officers and by safety inspectors. The automobile (owned, rented or borrowed) will enable a supervisor to come into the vicinity of maintenance of way gangs with minimum loss of time or exertion, and a pair of field glasses enables him to see what is going on without actually appearing on the scene. If a roadmaster "appears from nowhere" beside a track foreman who has been dozing in the shade of a tree for an hour while his gang unloaded ties, that foreman will think a long time before taking another nap while his men are engaged in dangerous work. A few such appearances during a season are sufficient to keep the foremen on a district constantly on the job. The bridge and building supervisor who occasionally walks into a bridge gang from the woods, instead of coming on a track car which gives warning of approach for several minutes, will soon have an alert and diligent force of men. One such appearance is worth many letters of advice or instruction about compliance with safety rules.

The gang which runs a motor car around a single track curve without flagging or stopping to listen, and suddenly finds the roadmaster standing in the track when they *knew* he went the other way two hours before, will for a long time be very careful to take the necessary precautions when going around curves. A signal maintainer or a section foreman who starts to run his track car over a highway crossing just ahead of an automobile that is approaching at the same time, and finds that the driver of the car was a safety inspector making a test on him, will probably be very careful about allowing vehicles to cross ahead of him thereafter, particularly if reasonable discipline is applied for the offense. Of course, surprise checks do no good whatever unless definite action is taken on all exceptions found.

Favors Them If Judgment Is Used

By W. H. SPARKS

General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

I consider this an eminently practical and important question to which the answer is yes, provided the tests and the subsequent disciplinary action are carried out with good judgment. It is possible, however, through the exercise of poor judgment to disorganize and discourage an otherwise efficient force of loyal men who are trying earnestly to live up to the rules and do their work to the proper standard.

There are few men who do not at times have lapses or drop below their normal watchfulness. Again there is much truth in the old saw that "familiarity breeds contempt." Men who come in daily contact with hazards are less likely to realize their magnitude or to take adequate preventive measures unless they are aroused at intervals by some outside action.

In my opinion surprise tests properly carried out, without subsequently harassing the foremen or men about improper practices that may be discovered, followed by proper disciplinary action, are both practicable and beneficial. They provide the means which are necessary to insure that the men will exercise the proper degree of watchfulness and will themselves be alert to avoid improper practices. A foreman who does not

know from what direction or at what time a superior officer may appear unexpectedly is less likely to violate the rules himself or overlook violations of rules or inferior work in his men than one who has every assurance that he will not be approached without ample warning.

An excellent example of the effect of proper instruction and previous surprise tests came to light on our line recently. A flagman sent out to protect a rail gang refused to come in when called. He was sent for the second time, but again refused to return. One of the assistant foremen then went out and found that the flagman was unacquainted with the former messenger, who was a new man, and had properly refused to accept his message. This incident was also a check on the foreman, since he should have inquired as to the acquaintance and sent a signed note or a man whom the flagman knew.

It should be the duty of every maintenance officer to make these tests whenever it is practicable for him to do so. They should cover every phase of the work that is being performed, and should be supplemented by kindly but firm instructions as to the proper procedure under a given set of circumstances. The officer who has never made such a test and who believes that maximum efforts are being made to live up to all rules will be surprised at some of the things he is sure to find.

Does Not Favor This Practice

By E. E. EDWARDS

Section Foreman, Southern Pacific, Frazier, Ore.

Surprise tests are entirely practicable from the standpoint of ability to make them, provided the country is hilly or there are woods or brush to provide adequate cover. In open prairie country such a practice might be attended with difficulties. The benefits to be derived make another story.

In my opinion the results will fall short of expectations. Under such a plan it would be the duty of the roadmaster or supervisor to make all or part of the tests. By close association with their subordinates, these officers soon learn their weaknesses and can readily enumerate the foremen that require watching or special attention. The careless foreman is usually one who follows the line of least resistance. In my opinion, good advice frequently given will bring better results than surprise tests. A careful study of safety rules and frequent discussions with one's superior officer are of maximum value, but like many doctrines, rules should be taught with moderation.

Instruction and Discussion Are Better

By E. C. NEVILLE

Bridge and Building Master, Canadian National, Toronto, Ont.

Unsafe practices and violation of rules are undoubtedly the fundamental causes of most of our personal injuries. It might appear, therefore, that any means of preventing such accidents would be warranted. Unfortunately, the accident rate on many roads is still too high, although the officers on some of these roads make it a practice to employ surprise tests. In view of this fact, it would seem that surprise tests do not solve the problem.

A supervisory officer has ample opportunity to check on unsafe practices and violations of rules without resorting to surprise tests, and of correcting them by explaining the necessity for strict adherence to instructions. The foreman is the key man in accident prevention, but as it is practically impossible for him to direct in detail every move that is made, the men must also be induced to take an active interest in this important subject. Where the men are organized, their regular meetings are often devoted to safety matters, and supervisory officers should avail themselves of every opportunity to appear before them and discuss these matters. I am convinced that these forms of co-operation between supervisory officers and foremen and between foremen and men will bring better results than any system of surprise tests.

Preboring Bridge Ties

To what extent is it practicable and economical to bore treated bridge ties for track spikes prior to treatment ?

Considers the Practice Entirely Feasible

By L. G. BYRD

Bridge and Building Supervisor, Missouri Pacific, Wynne, Ark.

It is entirely practicable to preframe and prebore bridge ties for track spikes, guard-rail lag screws and boat spikes where the latter are used to attach the ties to wood stringers for holding the track in line.

We use ties 8 in. by 8 in. by 10 ft. on our open deck trestles. Where these structures are more than 10 ft. high or more than 100 ft. long, we install an inside T-rail guard. The ties for these structures require 8 holes for track spikes, 2 holes for ¾-in. lag screws and, in every third tie, 2 holes for ¾-in. boat spikes. On curves, the boat spikes are driven in every alternate tie. In overflow districts, one anchor bolt is also placed at each bent, which passes through the center of the tie and the cap to hold the deck to the bents.

It is my practice to bore all of the holes mentioned, before the ties are treated. We have found that it results in a marked saving in first cost, since the boring can be done by power tools in the timber yard to much greater advantage than in the field, or after the ties have been applied. It also reduces the time required for the installation and minimizes or eliminates entirely the necessity for slow orders while the ties are being applied.

If the guard timbers are also preframed and bored to correspond with the ties, it is my experience that there is a total saving of approximately 25 per cent in the labor cost as compared with the old method. The preboring of the ties reduces the hazard of flying spikes, which cause more injuries than is generally realized. Finally, not the least advantage of the practice is that it results in a marked increase in the life of the material. As a rule, treated bridge ties fail under the rails and around spike and bolt holes where the encircling zone of treated wood has been broken, allowing the entrance of moisture and decay producing organisms into the untreated wood below.

Ties for steel bridges can and should be preframed and prebored the same as those for open-deck trestles.

Preboring Has Definite Advantages

By C. S. HERITAGE

Bridge Engineer, Kansas City Southern, Kansas City, Mo.

There are the same advantages in preboring treated bridge ties for track spikes that are gained in preboring treated crossties: Namely, by impregnating the wood around the spike hole with the preservative and increasing the holding power of the spikes. If there are numerous differences in the rail sections on different parts

of the road, it may be difficult to prebore the ties. This objection can be overcome, however, in the same way that it is for track ties—by boring the proper number of ties for each rail section, segregating them and distributing them only to the districts where they can be used.

It is generally recognized by those who use treated timber that, so far as possible, it should be framed and bored before treatment. The preboring for track spikes is just as important as other framing, since otherwise the spikes puncture the untreated material which lies beneath the treated zone, permitting the entrance of moisture and decay-producing organisms, especially where the spikes have loosened or respiking has been done without properly plugging the old holes.

There are instances where the center line of the track does not coincide exactly with the center line of the structure. In such cases, if the ties are dapped over the girders or stringers, it is impracticable to prebore for the track spikes unless the daps are cut wide enough to allow for some lining of the track by moving the ties. In this case it would also be impracticable to prebore for both track spikes and hook bolts.

These are exceptional cases and there are very few instances where the preboring for track spikes is impracticable. This practice requires careful study, however, to determine where the ties are to be used, and constant care to insure that they are properly segregated and distributed.

When the preboring is done mechanically at the tie-treating plant and a large number of ties are handled at one time, the cost per tie is small, probably not exceeding four cents, which is a small charge for the benefits that can be realized.

Organizing a Surfacing Gang

How should a surfacing gang of 35 men be organized for an average lift of 2 in. in gravel ballast, where the tie renewals are heavy and all ties must be spaced? How many lineal feet of track should such a gang complete in a day if it must "make ready" for six trains ?

Two Organizations Are Outlined

By H. S. TALMAN

Assistant Cost Engineer, Chesapeake & Ohio, Raleigh, W. Va.

As a basis of discussion it is assumed that this gang is working on single track and that the tie renewals average eight to a 39-ft. rail. Two organizations are practicable, depending on whether new ballast is applied. When additional ballast is not required, this organization should complete 890 ft. of track in 8 hrs. In this gang I would place a foreman in charge of the tie renewals and spacing and give him an assistant foreman to look after the surfacing. The force will then consist of a water boy, 2 flagmen and 30 laborers. The laborers would be allotted as follows: Eight men renewing ties, 4 men spacing, 12 men surfacing and 6 men filling in and dressing the ballast. The foreman should be directly in charge of the 8 men renewing ties, the 4 men spacing ties and 4 of the men surfacing. This unit makes a raise of about 1½ in., tamping only the ends of the ties in advance of the spacing and renewals. The assistant foreman should follow with the remainder of the gang, completing the raise and dressing the ballast.

In the second case a foreman and an assistant foreman are needed, and are in charge of the same groups as before. The foreman will have six men renewing ties, 3 men spacing and 4 men making the first raise ahead of the spacing and tie renewals. These men tamp only the ends of the ties. The assistant foreman will have 3 men filling in, 8 men completing the surfacing and 6 men unloading and dressing the ballast. It will be necessary for the 8 men who are making the final raise to assist with the filling in of the track with the old ballast for tamping. This organization should be able to complete, including the unloading and dressing of the new ballast, 650 ft. of track in an eight-hour day. In both organizations, the first men to complete their work for the day should be sent ahead to gage the track for the succeeding day's work.

Local Conditions May Change This Line-Up

By GEORGE M. O'ROURKE

District Engineer, Illinois Central, Chicago

Such a gang should be organized about as follows, where tie renewals are heavy:

1 foreman
1 man pulling spikes from ties marked for removal
2 men digging jack holes
2 men spacing ties with tie spacer
4 men on jacks
4 men on tamping tools
1 man handling hose behind tampers
4 men spiking
4 men filling in and dressing
2 assistant foremen
4 men removing old ties and putting in new ties
1 man removing and replacing rail anchors and handling spot board
2 men nipping up ties
2 men shoveling in ballast for tampers
1 man with bar to assist gagers

No doubt local conditions may cause changes to be made in this line-up.

It should be the aim of the foreman to keep the tampers working every minute of the working period. Where tie renewals are very heavy, more than 35 men may be required and where fewer men can keep out of the way with tie renewals, extra men should not be retained. Such a gang should complete between 800 and 1,000 ft. of track per day and make run-offs for six trains.

Have Every Man in His Place

By W. C. ROURK

Section Foreman, Texas & Pacific, Waskom, Tex.

One of the secrets of getting a good day's work is to have every man in his place all of the time. If this is done, more work will be accomplished with the same effort and no time will be lost in shifting the men from one job to another, which invariably results in some confusion until the adjustment is made. On this basis I would organize my gang as follows: Starting at the front, 1 claw-bar man pulling spikes and distributing new spikes; 2 pick men cleaning the cribs around the bad ties; 2 jackmen to lift the track to slightly below the final surface, to facilitate the removal of the ties, and to remove the old ties; 2 men with shovels and tongs to prepare the bed and insert the new ties; 2 spikers, who do the gaging, and 1 nipper; 16 men tamping, 8 men working inside the rails in pairs and 8 outside in pairs; 8 men filling in and dressing ballast; and 1 man to carry water, tend to the tools and do such other miscellaneous work as always arises.

Four of the outside tampers should be assigned to the jacks that are employed for the final lift. They not only "catch" the raise but do their share of the tamping. The foreman should have a line-up of trains and about 15 min. before one is due, should stop the spike pulling

and tie insertions and make his runoff. The claw-bar man, the forward jackman and those engaged in removing and inserting ties can drop back and dress ballast. The remainder of the men should line track and pick up and pile old ties.

This discussion has presupposed a renewal of 8 ties to a 33-ft. rail, and that new ballast is not required. On this basis, this gang should be able to complete in every particular, 850 ft. of track in 8 hrs.

Leaks in Waterproofing

What precautions should be taken to minimize the probability of leaks in waterproofing on solid-floor ballast-deck bridges? If they occur, how can they be repaired? Is it necessary to take the track out of service ?

Design and Drainage Are Important

By A. E. BECHTELHEIMER
Assistant Engineer of Bridges, Chicago & North Western, Chicago

Leaks in waterproofing, other than those which are caused by external damage, may result from several causes, the most important of which are improper design, defective drainage, inferior materials and poor workmanship. For this reason, I am of the opinion that the following precautions will eliminate practically all leaks which are within the control of the construction and maintenance forces: (1) Be certain that the design of the floor is adapted for the application of the type of waterproofing that is to be used; (2) include adequate provisions for quick drainage from the floor and away from the structure; (3) see to it that both materials and workmanship are maintained to a high standard.

Where design, drainage and workmanship are good, it will be possible to make repairs locally. Otherwise, a complete renewal is the only practicable procedure. If complete renewal is demanded, an opportunity is afforded to improve the design and thus eliminate the faults of the previous installation.

It is not necessary to take the track out of service, although the work will be greatly facilitated by doing so. When working under traffic, the rails should be carried directly on short-length blocking, the track ties serving as spacers.

Care Will Eliminate Many Leaks

By M. HIRSCHTHAL
Concrete Engineer, Delaware, Lackawanna & Western, Hoboken, N. J.

This question is one of waterproofing application, with the added problem of making repairs when the waterproofing does not function perfectly. Waterproofing may fail because of the puncturing of the reinforced blanket, either during application by carelessness or afterwards by the pressure of the sharp edges of the ballast as a result of the superimposed load. When such damage occurs, the subsequent leak almost invariably finds an outlet through a construction joint in the concrete slab. For this reason, all construction joints should be thoroughly calked, should have a priming coat applied or an additional ply of waterproofing cloth and asphalt mopping should be provided.

One of the fundamental precautions to be taken to eliminate leaks in waterproofing is to insure that the various layers of cloth in the waterproofing blanket have ample lap over the joints of the preceding layer and that they be constantly guarded against damage from the edges of sharp tools that may be left carelessly or dropped by some of the workmen. It is not unreasonable to assume that many waterproofing failures could be traced to observe these precautions, if all of the facts were available.

After the waterproofing has been applied, there should be no delay in placing the protection coat. This may be any one of three types, (1) concrete, (2) aspalt mastic applied hot or (3) precast asphalt blocks or asphalt plank. In my opinion, by far the most effective protection is provided by the precast asphalt (mastic) block, because of its greater strength and durability, its greater uniformity in both quality and size, and its ease of application.

Another precaution of importance relates to design. This is proper provision for the drainage of water, including the pitching of the slab, provision for and careful design of expansion joints, the selection of their location, the drainage of the water away from them, and provision for screens at drainage openings and for pipe of sufficient diameter to insure that it will not become clogged during freezing and thawing weather.

When leaks do occur, repairs are a serious problem, except those that are due to the clogging of the drain pipes and the subsequent collection of water with a head greater than the waterproofing was designed to resist. When not due to this cause, the only alternative is to take up the track and make the needed repairs, unless the engineer wishes to resort to the expedient of stopping the leak at its exit. This can be done by means of one of the compounds which are based on an exceedingly quick-setting cement. For obvious reasons, I prefer to apply the waterproofing or the repairs at the entrance of the water rather than at its exit.

Repainting Wood Surfaces

When repainting wood surfaces, what special precautions are necessary that were not required for the first painting ?

Many Precautions Are Required

By H. CUNNIFF
General Painter Foreman, Delaware & Hudson, Green Island, N. Y.

Before repainting any structure, all necessary repairs should be completed. If the old paint film is in good condition, the surface should be washed thoroughly with a good cleaning compound, care being exercised to remove all traces of the cleaner. The first coat should be rich in turpentine, so that it will dry to a semi-gloss, thus making a desirable surface for the adhesion of the second coat. The thinner for the second coat should consist of 30 per cent turpenine and 70 per cent linseed oil. Any puttying that may be necessary should be applied after the first coat is dry.

Prior to repainting a wood surface upon which the paint has failed, a careful inspection and an analysis should be made by a competent person to determine why the failure occurred. This failure may be accompanied by the checking, alligatoring, cracking, flaking, scaling, blistering or peeling of the old film. The underlying cause of the failure may have been poor lumber, inadequate or poor flashing, an inferior type of construction, improper preparation of the surface or poor workmanship, the latter including the application of paint to a

previous coat which is not thoroughly dried. This examination will usually reveal the cause of the failure, and the first step in repainting is to remove this cause.

Where a failure has occurred, the old film should be completely removed, preferably by burning, and the exposed surface sandpapered This surface will be partly filled, so that the first coat of the new application should be rich in turpentine. All nail holes, checks or cracks in the lumber should be well puttied. The second coat should be thinned with turpentine and linseed oil in equal proportions, while the thinner for the third coat should consist of turpentine, 30 per cent, and linseed oil 70 per cent.

If the grain of the lumber has been raised by weathering as a result of inadequate paint protection, the first coat should be thinned with linseed oil that contains only enough turpentine to insure drying. This coat should be well brushed out and worked into the wood. The second and third coats should be as outlined in the preceding paragarph.

Thorough Cleaning Is Important

By HARRY J. BARKLEY

Bridge and Building Foreman, Illinois Central, Carbondale, Ill.

To begin with, all repairs to the structure that is to be painted should be completed before the painters arrive. All loose paint should be removed with scrapers and wire brushes. The burning torch should not be used for this purpose, since it is both expensive and a fire hazard. The first coat is especially important, particularly under overhanging eaves where the sun never strikes the surface. If the paint is too rich in oil or is "too thick," it may be expected to peel. On these surfaces the point should be thin and contain plenty of turpentine. Those surfaces which are exposed more directly to the sun and weather require a larger proportion of oil, so that good judgment born of experience is needed in repainting wood surfaces. In my opinion when a wood surface needs repainting equally satisfactory results can be obtained by applying a single coat if one is assured that repainting of this character will be done annually.

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One or Two Lines of Drains?

Under what conditions is it sufficient to install subsurface drainage on only one side of a single-track cut? Under what conditions are the advantages of a second line of drainage sufficient to justify its cost? **?**

Two Lines of Drainage Rarely Necessary

By GEORGE S. FANNING

Chief Engineer, Erie, Cleveland, Ohio

Subsurface drainage is required in any cut where the soil forming the roadbed contains free water. The source of the water must be determined. Generally it will be found that water from a stream, pond or lake, or the rainfall on some undrained area at a higher elevation is flowing through pervious strata to the roadbed. A subsurface drain of either No. 1 vitrified-clay sewer pipe with bell ends or corrugated galvanized-iron pipe, laid in a trench and backfilled with clean crushed stone or washed gravel, should be installed on the side of the cut between the source of the water and the roadbed, where it will intercept the underground flow. In extremely wet cuts, the main alone may not be sufficient and laterals extending under the track may also be required.

In single track cuts there will rarely be any necessity for more than one main. The rare exception will be found only where there are sources of ground water on both sides of the cut, as for example in a deep summit cut located in a saddle below the original ground water level. In such a case mains on both sides of the track may be required to stabilize the roadbed.

Two Lines Can Usually Be Justified

By J. R. WATT

Engineer Maintenance of Way, Louisville & Nashville, Louisville, Ky.

I am of the opinion that drainage lines on both sides of the track are justified in all cases where they can be installed at reasonable cost. With two separate lines the waters will be carried off more quickly, and there is less likelihood that any disturbance of, or obstruction in, the line will affect the entire installation.

If any exception is to be made, I would say that a single line might be used where rock excavation is necessary for most of the distance. Even there two lines would be better, but where such heavy expense is involved, the money can be spent to better advantage by installing drainage over a greater length of track. Also, if the drainage is being installed to intercept water reaching the track from one side only, a single line should suffice.

A Drain on One Side Is Sufficient

By F. M. THOMSON

District Engineer, Missouri-Kansas-Texas, Parsons, Kan.

Subsurface drainage for cuts has been installed extensively by the railways with which I am now and have formerly been employed. Many methods and materials have been tried with varying degrees of success. My experience leads me to believe that in single-track cuts where pipe is employed, the main should be placed well toward the back of the cut, with laterals extending through the roadbed at least to the opposite ballast toe line.

The main trench should be back-filled with pervious material, such as locomotive cinders, crushed rock or washed gravel to permit infiltration of water without danger of fouling the pipe with mud. If vitrified pipe is used, it should have bell ends and the pervious back-filling should cover the pipe to a sufficient depth to fill it completely in case the tile is crushed; thus permitting it to continue to function as a drain.

Laterals may be smaller than the main and should be similarly surrounded with pervious back-filling, except that within the limits of the ballast section the pervious material should fill the trench and join the ballast to insure a quick runoff of the water drained from the ballast, since the primary purpose of subsurface drainage is to dispose of the water quickly. Our experience indicates that one main with laterals as described, makes a better job and insures drainage from all water pockets, than two lines with laterals which only extend into the roadbed.

A second line of drainage might have sufficient advantages to justify its cost where a large amount of seepage enters the roadbed from both sides of the cut and the main drain is used largely as an intercepting drain as well as an outlet for the laterals.

What Our Readers Think

Ties Concave Up or Concave Down?

Detroit, Mich.

To the Editor:

Without taking exception to the excellent answers to your question "Heartwood Up or Down," which appeared on page 339 of your May issue, may I mention an exception? Service life of ties is of great importance but the function of the tie in holding the rails to gage and distributing the loads to the ballast and roadbed must also be considered. To function properly, a tie should be laid any side up to give the best bearing—occasionally a crooked or a warped tie must be dealt with. The practical trackman will invariably and quite properly lay this tie with the convex surface up, so that the ends embed themselves solidly in the ballast and will hold the rails firmly in surface. If laid with the concave surface up, the tie has a tendency to rock, which no amount of tamping and bedding will entirely overcome. Every tie should be scrutinized with a view to the selection of the bearing surface. Straight ties should, of course, be laid heart side down; warped ties, belly up.

Placing ties "straight across" the track is quite as important. Ties that tend to "bunch" usually were not laid at right angles to the rails to begin with. Too much care can hardly be taken with these details of tie application. It is astonishing how few ties actually are spiked down "straight across the track," and observation of track in process of construction will prove that this elementary duty is flagrantly disregarded.

E. R. Lewis,
Principal Assistant Engineer, Michigan Central.

Renewing Turnouts

Russell, Ky.

To the Editor:

I am very much interested in the discussions that appear in What's the Answer column of *Railway Engineering and Maintenance,* from month to month, since they give evidence of being based on the practical experience of those who contribute to them. For this reason they are of high value to any alert maintenance man, particularly as they often contain information that is not available in any other literature.

I was particularly struck by the wide range of man-hour requirements, from 48 to 200, for renewing turnouts, which were given beginning on page 402 of the June issue. An analysis of these answers indicated that there was considerable variation in the bases of the several discussions. The locations assumed ranged from a busy terminal to one out on the line; in some cases a rail crane was used, in others this equipment was disregarded; some included the preparatory work and cleaning up, others did not; tie renewals may or may not have been included. Taking all these factors into account, however, there is still a rather wide variation.

In my opinion an important omission in these discussions was the failure to stress the fact that no matter how many man-hours are required to renew a turnout under the conditions that must be met, no part of the work should be slighted and every man-hour necessary to complete it should be charged against the work.

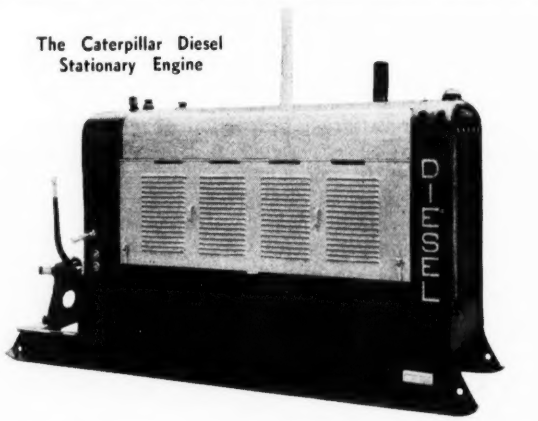
We are constantly devising means and providing equipment to reduce unit costs in maintenance, and it is proper that we should do so. The turnout, however, is the greatest hazard in our present form of track construction. For this reason, we should not press our campaign of economy to the point where any part of our switch maintenance will be neglected. In other words, in renewing or maintaining switches, superior workmanship is not only cheapest in the long run; it is also the safest. Where the overall cost of renewal can be reduced by providing power machines to minimize hand labor, this should by all means be done.

What I want to stress particularly is that while we may be justified in figuring to the last fraction our costs on other classes of work, we cannot afford to be too rigid in the matter of man-hours when it comes to the renewal or maintenance of turnouts, for by so doing we may be reducing the quality of a class of work that should be kept to the highest standard.

W. H. Sparks,
General Inspector of Track, Chesapeake & Ohio.

Stationary Engines Now Offered by Caterpillar

THE power units employed by the Caterpillar Tractor Company, Peoria, Ill., in its various tractor models are now available for use also as stationary engines with suitable mountings and housings, adapting them for portable, semi-portable and stationary service. This line of engines is headed by the Caterpillar Diesel which is a



The Caterpillar Diesel Stationary Engine

four-cylinder engine with a 6⅛-in. bore and a 9¼-in. stroke, turning at 700 r.p.m. It also includes four models of four-cylinder gasoline engines. The sizes and speeds of these gasoline engines are as follows:

Engine	Bore (Inches)	Stroke (Inches)	Speed (r.p.m.)
Sixty-Five	7 -in.	8½-in.	650
Fifty	5½ "	6½ "	950
Thirty-Five	4⅞ "	6½ "	950
Twenty-Five	4 "	5½ "	1,250

All of the engines are mounted integrally with the radiator on steel channel beam skids and are enclosed in louvered hoods.

The characteristics of the Model Fifty are typical of the other models. It develops a brake horsepower of from 40 to 67 within the speed range of 500 to 950 r.p.m. Cooling equipment for this model consists of a gear-driven 24-in. fan having 6 blades, and a gear-driven centrifugal pump. Other features include an Ensign carburetor and an Eiseman magneto with an automatic impulse coupling.

News of the Month . . .

More Air-Conditioned Trains

Each of the four railroads operating between Chicago and St. Louis placed an air-conditioned train in service between these points about July 1. These trains, which are equipped with various types of air-conditioning equipment, include the Banner Blue Limited of the Wabash; the Daylight Special of the Illinois Central; the Alton Limited of the Alton; and the La Salle of the Chicago & Eastern Illinois.

Many Never Ride Trains

A number of interesting facts regarding the attitude of the American public toward the railroads have been brought to light recently by reason of the greater publicity being given Pullman accommodations and excursions. Excursions on the Pennsylvania have disclosed, according to statements of officers of the road, that 75 per cent of the patrons of these excursions had never before traveled in a sleeping car. Moreover, it is stated that a considerable percentage of the growing generation have yet to take their first ride on a railroad train.

Advocates Lower Passenger Rates

The establishment of railroad passenger rates of two cents a mile in coaches and of three cents a mile in sleeping cars without the surcharge was advocated as a means of attracting passenger traffic back to the rails, by L. C. Fritch, vice-president of the Chicago, Rock Island & Pacific, in an address at Springfield, Ill., on June 2. Mr. Fritch pointed out that the decline in passnger traffic, which amounted to 43 per cent between 1921 and 1930, was attributable mainly to the private motor car, with motor coaches operating as a secondary influence, and that the railroads must adopt drastic measures to make rail travel more attractive as to both rates and service.

Rail Earnings Continue Decline

For the first four months of 1932, the Class I railroads of the United States had a net railway operating income of $87,535,374, which was at the annual rate of return of 1.27 per cent on their property investment, as compared with 2.24 per cent for the corresponding period in 1931, according to reports compiled by the Bureau of Railway Economics. Operating revenues for the four months amounted to $1,100,435,859, a decrease of 24 per cent as compared with last year, while operating expenses totaled $873,883,470, a decrease of 23.9 per cent. For April the net railway operating income was $20,621,017, which was at the annual rate of return of 1.17 per cent, as compared with a return of 2.25 per cent in April, 1931.

More Employee Organizations

State-wide organizations of railway employees, formed to aid the railroads in their fight for equal taxation and regulation of competing forms of transportation, are continuing to be founded in various states. Representative railway employees of Birmingham, Ala., held a meeting recently to lay the foundation for such an organization in that state, while preliminary meetings of railway employees organization have also been eral points in North Carolina. Preliminary steps to the formation of railway employees, organization have also been taken in Texas and several other states, while the membership of existing organizations is continuing to grow.

"Mystery" Excursions

A new form of excursion, known as the "mystery" excursion, has been tried on at least three roads in recent weeks where it has achieved considerable success as a means of attracting passengers. These excursions are designed to appeal to the imagination of the prospective passenger, and carefully selected hints as to the various pleasures and features that the trip will afford are the only indications the passenger has of what lies ahead. Only the hours of departure and return are published and even the train crew is under sealed orders. Such excursions have been operated by the Missouri Pacific out of St. Louis, Mo., by the Baltimore & Ohio out of Chicago and by the Southern out of Cincinnati, Ohio, and Washington, D. C.

To Study Government Competition

The House of Representatives of the United States adopted a resolution on May 31, providing for the appointment of a special committee of five representatives for the purpose of investigating "government competition with private enterprise and all other questions in relation thereto that would aid the Congress in any necessary remedial legislation." Alfred P. Thom, Jr., general solicitor of the Association of Railway Executives, requested that the committee include within the scope of its work an investigation into the operations of the government-owned Inland Waterways Corporation, which is in competition with the railways, and also the government-subsidized competitors of the railways operating on the highways. The committee is to hold hearings and make a report to the House of Representatives by December 15.

Inventories Lower

On May 1, the inventories of material and supplies of the Class I railroads of the United States were approximately $18,000,000 less than they were in January, according to figures compiled by the Railway Age from the reports of 24 carriers which ordinarily account for about 30 per cent of the inventories of all roads. Tie stocks on the 24 roads amounted to $27,129,000 on May 1, as compared with $28,799,000 in January, while stocks of rail, which amounted to $8,129,000, showed an increase over January.

Extend Pick-Up and Delivery Service

Further recognition of store-door pick-up and delivery service as a means of drawing traffic back to the rails found expression on June 25 when the Reading and the Pennsylvania established such service between the Philadelphia-Camden territory and Atlantic City, N. J., and Ocean City. A flat charge is made for each shipment, and the rates, as filed with the Interstate Commerce Commission, are considerably lower than those prevailing prior to the inauguration of the new service. Pick-up and delivery service is afforded by the Railway Express Agency.

April Freight Traffic

Freight traffic handled by the Class I railroads of the United States in April amounted to 21,255,361,000 net ton-miles, which was a reduction of 7,456,122,000 net ton-miles, or 26 per cent under April, 1931, and a reduction of 13,644,994,000 net ton-miles, or 39.1 per cent, under April, 1930, according to reports compiled by the Bureau of Railway Economics. In the Eastern district the volume of traffic was 22.2 per cent under a year ago, in the Southern district the reduction was 32.4, and in the Western district it was 28.8 per cent.

Rate Increase Dwindles Away

In spite of the emergency freight rate increase granted to the railroads by the Interstate Commerce Commission, effective January 4 of this year, and then estimated to amount to about three per cent, the average revenue received by the Class I railways for hauling a ton of freight a mile in the first three months of this year was less than it was in the same period last year, according to figures of the commission. The average was 1.044 cents as compared with 1.046 cents in 1931. This reduction is attributed to two reasons, both of which owe their origins to the increasing competition of other forms of competition—first, repeated reductions in rates and, second, changes in the character of traffic carried.

Association News

American Wood Preservers' Association

Approximately 40 members of the executive and other committees of the American Wood Preservers' Association and of the Committee on Wood Preservation of the A. R. E. A. met at Washington, D. C., on June 21-22 to transact the work of their respective committees. On the second day the group inspected the work being done by the Bureau of Standards and then gathered at the White House for a brief conference with President Hoover.

American Railway Engineering Association

Five committees held meetings during June, as follows: Economics of Railway Labor, at Chicago, on June 10; Special Committee on Waterproofing, at Chicago, on June 16 and 17; Wood Preservation, at Washington, D. C., June 21 and 22; Wooden Bridges and Trestles, at Chicago, on June 24; Yards and Terminals, at Buffalo, N. Y., on June 27.

A meeting of the Committee on Iron and Steel Structures is scheduled to be held at Detroit, Mich., on July 21 and 22. Arrangements have also been made for a meeting of the Masonry committee to be held at Chicago during July, but the date has not yet been determined.

Metropolitan Track Supervisors' Club

The annual meeting of the Metropolitan Track Supervisors' Club was held on June 18 at Keen's Chop House, New York, with about 50 members and guests in attendance. After a special dinner, served at 6 p. m., the following officers were elected for the ensuing year: W. O. Dennis, inspector, Lehigh & New England, president; T. E. MacMannis, supervisor, Central Railroad of New Jersey, first vice-president; C. H. Morse, general track inspector, New York Central, second vice-president, and W. E. Gadd, secretary-treasurer. The following members were elected to the executive committee under F. W. Biltz, retiring president: W. H. Haggerty, supervisor, New York, New Haven & Hartford; M. C. Martin, supervisor, New York, New Haven & Hartford, and G. W. Hoover, the Buda Company.

Trade Publication

No-Ox-Id Filler Red—The Dearborn Chemical Company, Chicago, has issued an 8-page circular descriptive of its No-Ox-Id Filler Red for protecting metal structures and fixtures against rust. The various uses of this filler, which is also supplied in black and gray, are also listed.

Personal Mention

General

R. W. Simpson, assistant general manager of the Atlantic region of the Canadian National, with headquarters at Moncton, N. B., and formerly assistant chief engineer of the Intercolonial (now part of the C. N. R.), retired on June 1.

Engineering

R. O. Rote, chief engineer of the New York Central, Lines West of Buffalo, with headquarters at Cleveland, Ohio, has had his jurisdiction extended to include the maintenance of way and signal departments.

Porter Berryhill, a roadmaster on the Northern Pacific, at Spokane, Wash., has been appointed chief engineer of the Alaska Railroad, with headquarters at Anchorage, Alaska, to succeed **C. H. Holmes,** who died on April 9, as noted in the May issue of *Railway Engineering and Maintenance.*

F. H. Cook, division engineer on the International-Great Northern, with headquarters at Palestine, Tex., has been appointed assistant chief engineer, with the same headquarters, to succeed **T. S. Bond,** who has been appointed assistant engineer at San Antonio, Tex. Mr. Bond replaces **H. A. March,** who has been assigned to other duties.

Following the consolidation of the First and Second districts of the Chicago, Rock Island & Pacific, which comprise the entire system, **F. T. Beckett,** district engineer maintenance of way of the Second district, with headquarters at El Reno, Okla., has been appointed to the newly-created position of engineer maintenance of way of the system, with headquarters at Kansas City, Mo., and the position of district engineer maintenance of way at El Reno has been discontinued. The position of district engineer maintenance of way of the First district, which has been held by **L. J. Hughes,** with headquarters at Des Moines, Iowa, has also been abolished.

William C. Cushing, engineer of standards of the Pennsylvania, with headquarters at Philadelphia, Pa., retired from active service on May 31, with a service record of 45 years in the engineering and maintenance of way departments of this road. Mr. Cushing was born at St. John, N. B., on March 18, 1863, and was educated at the University of New Brunswick and the Massachusetts Institute of Technology, graduating from the latter institution in civil engineering in 1887. In the same year he took up railway service as a rodman on the engineering corps of the Jeffersonville, Madison & Indianapolis (now part of the Pennsylvania). Two years later he was appointed engineer maintenance of way of the Cincinnati & Muskingum Valley (now also part of the Pennsylvania), where he remained until 1890, when he was appointed division engineer. In 1901, Mr. Cushing was transferred to the operating department as division superintendent, but two years later he returned to the engineering department as chief engineer maintenance of way of the Southwest system of the Pennsylvania. In 1918 his jurisdiction was extended over the Northwest system as chief engineer

William C. Cushing

maintenance of way of the Lines West of Pittsburgh, which title he retained until 1920, when he was appointed engineer of standards of the Pennsylvania system, with headquarters at Philadelphia, which position he held continuously until his retirement. Mr. Cushing has been active in the affairs of a number of technical societies, and in 1911-12 he was president of the American Railway Engineering Association.

F. M. Hawthorne, engineer maintenance of way of the Lake division of the Pennsylvania, with headquarters at Cleveland, Ohio, has been appointed division engineer of the Cleveland division, with the same headquarters, to succeed **J. M. Fox,** who has been transferred to the Indianapolis division, with headquarters at Indianapolis, Ind. Mr. Fox replaces **C. O. Long,** who has been appointed assistant division engineer of the Middle division, with headquarters at Altoona, Pa. **David Davis, Jr.,** division engineer, with headquarters at Philadelphia, Pa., has been transferred to the Buffalo division, with headquarters at Buffalo, N. Y., succeeding **A. H. Tasker,** who has been appointed supervisor of telegraph and signals of the Middle division, with headquarters at Altoona.

R. S. Stewart, engineer maintenance of way of the Philadelphia Terminal division of the Pennsylvania, with headquarters at West Philadelphia, Pa., has been appointed division engineer of the Atlantic division, with headquarters at Camden, N. J., where he will succeed **Spencer Danby,** who has been transferred to the Middle division, with headquarters

at Altoona, Pa. Mr. Danby succeeds **H. W. Anderson,** who has been appointed chief draftsman on the Eastern Pennsylvania division.

W. C. Perkins, roadmaster of the Dillon district of the Utah division of the Oregon Short Line, with headquarters at Dillon, Mont., has been promoted to division engineer of the Kansas division of the Union Pacific Railroad, with headquarters at Kansas City, Mo., succeeding **A. R. Jurden,** who has been assigned to other duties. Both these roads are units of the Union Pacific System.

Track

W. B. Marshall, roadmaster on the Cincinnati, New Orleans & Texas Pacific (part of the Southern), has moved his headquarters from Lexington, Ky., to Somerset, where his office will be consolidated with that of **M. W. Self,** roadmaster at the latter point.

W. L. Spittler, track foreman on the Oregon Short Line, with headquarters at Lawen, Ore., has been promoted to roadmaster of the Dillon district of the Utah division, with headquarters at Dillon, Mont., to succeed **W. C. Perkins,** whose promotion to division engineer is noted elsewhere in these columns under engineering.

W. A. Chandler, resident engineer on the Canadian National, with headquarters at Winnipeg, Man., has been appointed relieving roadmaster on the Calgary division, with headquarters at Calgary, Alta., to succeed **D. H. Ford,** who has retired. **D. A. McNeill,** roadmaster with headquarters at Stratford, Ont., has been assigned to other duties and his position abolished.

A. L. Campbell, roadmaster of the Dunsmuir district of the Shasta division of the Southern Pacific, Pacific lines, with headquarters at Dunsmuir, Cal., has been transferred to the Modoc district of the same division, with headquarters at Alturas, Cal., succeeding **J. Stewart,** who is on a leave of absence, and the territory comprising the Dunsmuir district has been divided among other roadmasters. In connection with these changes, the headquarters of **J. O. Johnson,** roadmaster of the Siskiyou district of the Shasta division, with headquarters at Ashland, Ore., have been moved to Dunsmuir.

J. H. Kansinger, roadmaster on the Atlantic Coast Line, with headquarters at Rocky Mount, N. C., has been promoted to general roadmaster of the Western district of the Second division, with headquarters at Waycross, Ga., to succeed **W. A. McCullough,** who has retired. Mr. Kansinger was born on February 5, 1894, at Chattanooga, Tenn., and was educated at the University of Tennessee. From 1914 to 1918 he was in the service of the Interstate Commerce Commission, resigning from this organization in the latter year to enter the United States Army. Mr. Kansinger entered the service of the engineering department of the Atlantic Coast Line in October, 1919, serving in various positions until September, 1925, when he was appointed roadmaster on the Haines City branch, with headquarters at Sebring, Fla. In 1930, he was transferred to the Richmond district at Rocky Mount, N. C., where he was located at the time of his recent promotion to general roadmaster of the Western district of the Second division.

J. J. Clutz, supervisor on the New York division of the Pennsylvania at Jamesburg, N. J., has been transferred to the Philadelphia division, with headquarters at Middletown, Pa. **J. L. Cranwell,** assistant supervisor on the New York division, has been transferred to the Philadephlia division, with headquarters at Downington, Pa., to succeed **P. W. Early,** who has been appointed assistant on engineering corps on the Central Pennsylvania division. **C. D. Merrill,** supervisor on the Williamsport division, has been transferred to the New York zone of the Pennsylvania.

The following roadmasters on the International-Great Northern have recently moved their headquarters to new locations. **A. C. Soechting,** Crystal City, Tex., to San Antonio; **S. C. Grizzle,** Mart, Tex., to Palestine; and **J. G. Maynor,** Lake Charles, La., to Kinder. **B. E. Glenn,** who formerly was a roadmaster with headquarters at Mart, Tex., has been reappointed to a similar position at Valley Junction, Tex. **M. H. Smith,** until recently a roadmaster on the I.-G. N. at San Antorio, Tex., has been appointed roadmaster on the San Antonio, Uvalde & Gulf, with headquarters at Gardendale, Tex. Both these roads are operating units of the Missouri Pacific Lines.

La Verne C. Campbell, assistant roadmaster on the Wisconsin division of the Chicago & North Western, with headquarters at Chicago, has been promoted to roadmaster of the Eighth subdivision of the Dakota division, with headquarters at Tracy, Minn., succeeding **D. C. Murphy,** who has retired, and the position of assistant roadmaster at Chicago has been abolished.

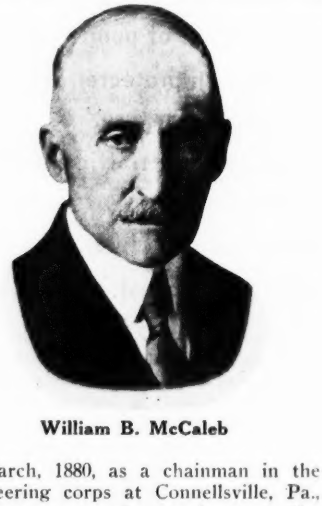
Mr. Campbell's service with the North Western dates back 20 years. He was born on January 8, 1898, at Union, Ill., and after a public school education he entered the service of the North Western in June, 1912, as a water boy. He spent the next winter in school, but returned to the North Western the following spring as a trackman, being appointed assistant agent at Irving Park, Ill., a few months later. In 1916, Mr. Campbell was made an acetylene welder on the Wisconsin division, which position he held until December, 1928, when he was appointed supervisor of crossing protection. He retained the latter position until August 1, 1929, when he was promoted to assistant roadmaster on the Wisconsin division, with headquarters at Chicago, which position he was holding at the time of his recent promotion to roadmaster, which was effective on June 9.

Bridge and Building

D. B. Taylor, a carpenter foreman on the Baltimore & Ohio, at Chicago, and formerly a master carpenter on this road, retired from active service on May 1, after more than 40 years of service with the B. & O. Mr. Taylor was born at Clarksburg, W. Va., on July 21, 1865, and entered the service of the Baltimore & Ohio on February 5, 1890, as a carpenter on the Monongah division. He was promoted to bridge inspector in July, 1896, which position he held until March, 1901, when he was further advanced to carpenter foreman. Six years later Mr. Taylor was promoted to master carpenter on the Wheeling division, where he remained until June 1, 1910, when he was transferred to the Chicago division. On October 16, 1920, he returned to the Monongah division as master carpenter, where he remained until June 9, 1925, when he left railway service to enter private business. On his return to the service of the B. & O. on February 18, 1927, Mr. Taylor was appointed a bridge inspector on the Akron division. Subsequently, he was again appointed carpenter foreman with headquarters at Chicago, which position he was holding at the time of his retirement.

Water Service

William B. McCaleb, general superintendent of water service of the Pennsylvania, following a long and varied carreer in the maintenance, operating and water service departments of that road, was retired at the age of 70 on June 1. Mr. McCaleb was born at Mt. Pleasant, Pa., on May 18, 1862, and was educated at Mt. Pleasant Institute. He entered the service of the Pennsylvania



William B. McCaleb

in March, 1880, as a chainman in the engineering corps at Connellsville, Pa., and was soon made a rodman on the Pittsburgh division, being later transferred to the principal assistant engineer's office at Altoona, Pa. In April, 1883, he was appointed assistant supervisor on the Pittsburgh division, at New Florence, Pa., following which he was

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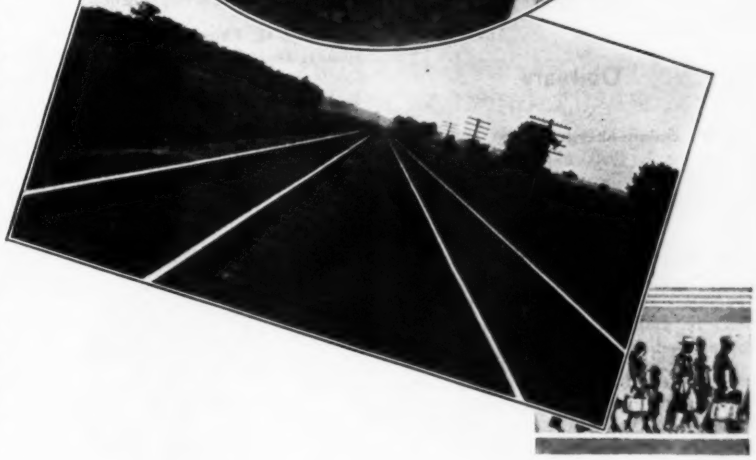

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Standard Asphalt Road Oil applied to the road-bed and the right-of-way eliminates dust, relieving the passengers of a very disagreeable condition, and adding greatly to their comfort. It also improves the appearance of the passenger equipment, and reduces wear and tear on equipment.

The use of Road Oil on the road-bed also reduces the maintenance cost, on account of its waterproofing effect and aids in preventing disintegration.

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The application of the correct grade of Road Oil is the most practical and economical method of eliminating weeds, and aids in giving a better general appearance to the entire right-of-way.

There is no one thing that adds more to the pleasure of the traveling public and attracts more patrons, outside of the car equipment itself, than the use of Road Oil on the road-bed and the right-of-way.

The reasonable cost and the benefits received justify the use of Road Oil, and especially where the railroad is catering to the patronage of the traveling public there is no question about the justification of the use of oil.

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transferred to Harrisburg, Pa., and Greensburg. In October, 1886, he was promoted to supervisor on the Tyrone division, and later served in this capacity at Middletown, and Downingtown, Pa. In December, 1889, Mr. McCaleb was further advanced to assistant engineer of the Western Pennsylvania division, with headquarters at Allegheny City, Pa., and in January, 1893, he was transferred to the Middle division, at Harrisburg. On October 1, 1895, he was promoted to superintendent of the Bedford division, with headquarters at Bedford, Pa., and on December 10, 1896, he was appointed superintendent of the Sanbury and Shamokin divisions, with headquarters at Sunbury, Pa. On May 1, 1902, he was appointed superintendent of the Middle division, at Harrisburg, and on June 1, 1903, was made superintendent of the Philadelphia division, remaining at Harrisburg. Mr. McCaleb was appointed general superintendent of water companies of the Pennsylvania System on October 25, 1917, with headquarters at Philadelphia, and on September 1, 1920, he was also made engineer of water service for the Pennsylvania Railroad. On May 1, 1929, he became general superintendent of water service. He was granted a leave of absence on January 1, 1932, and, under the pension regulations of the road, was retired on June 1.

Obituary

J. P. Smallenberger, who retired on December 1, 1930, as master carpenter of the Meadville division of the Erie, died at his home at Meadville, Pa., on April 9.

W. MacDonald, master carpenter on the Chicago, Burlington & Quincy, with headquarters at Aurora, Ill., died at that place on June 12, following an operation for appendicitis.

Frederick L. Burrell, retired supervisor of bridges and buildings on the Chicago & North Western, with headquarters at Fremont, Neb., died on May 30, at his home at that point.

Michael Clarke, roadmaster on the Gulf, Colorado & Santa Fe, with headquarters at Temple, Tex., died suddenly of heart failure on May 21. Mr. Clarke was born on December 12, 1873, at Liverpool, England. His early railway experience in this country included service on the Missouri-Kansas-Texas as a track foreman at Greenville, Tex., and with the St. Louis Southwestern as a track foreman at Commerce, Tex. He entered the service of the Gulf, Colorado & Santa Fe on January 1, 1907, as a track foreman on the Northern division at Cleburne, Tex., being promoted to extra gang foreman on the same division in April of that year. Two years later Mr. Clarke was transferred to the Southern division and on September 1, 1910, he was advanced to assistant roadmaster. He served as a roadmaster from December 3, 1911, until the time of his death.

Supply Trade News

Personal

J. H. Fitch, Jr., has been appointed sales manager of a new office opened by the **Inland Steel Company** in the Fisher building, Detroit, Mich.

Frederick S. Overton, secretary and a director of the Ingersoll-Rand Company, New York, died on June 4. Mr. Overton had been in the service of the company for the past 30 years.

C. C. Hobart, president of the Hobart Brothers Co., Troy, Ohio, manufacturers of railway welding equipment, died at his home in Troy, on June 3, at the age of 77, following a prolonged illness.

John H. Dodge, president of the **Lowell Wrench Company,** Worcester, Mass, has bought the **Safety Wrench & Appliance Company,** Worcester, manufacturers of the Swaco safety hopper car wrench, and the Swaco car mover; their products will be manufactured in the future by the Lowell Wrench Company.

George G. Thorp, vice-president of the **Illinois Steel Company,** Chicago, has been elected president to succeed **Eugene J. Buffington,** who will retire at his own request on July 1, under the pension plan of the **United States Steel Corporation,** of which the Illinois Steel Company is a subsidiary. Mr. Buffington will continue as a director. **George Cook Kimball,** vice-president of the **American Sheet & Tin Plate Co.,** Pittsburgh, Pa., also a subsidiary of the U. S. Steel Corporation, has been elected vice-president of the Illinois Steel Company to succeed Mr. Thorp. **Theodore W. Robinson,** a vice-president of the Illinois Steel Company, retired on June 6 at the age of 70 years.

Eugene J. Buffington

Mr. Buffington was born at Guyandotte, W. Va., on March 14, 1863, and graduated from Vanderbilt university in 1883. In 1884 he entered business as a manufacturer of wire nails, organizing the American Wire Nail Company, Covington, Ky., and occupying the position of treasurer. In 1889 the company was moved to Anderson, Ind., where he remained until 1898, when he became secretary and treasurer of the American Steel & Wire Co., Chicago. On January 1, 1899, he became president of the Illinois Steel Company, which position he held until his retirement.

Mr. Robinson began his business career with the Joliet Steel Company as a chemist and upon the formation of the Illinois Steel Company in 1889, he was sent to the Milwaukee, Wis., works of this company in charge of blast furnace operations. Following the organization of the Colorado Fuel & Iron Co., he took charge of its Pueblo works and for a number of years supervised the company's iron and steel manufacturing activities. On his return to the Illinois Steel Company in 1900, he was made general manager and later vice-president.

Charles L. Wood, vice-president and general manager of sales of the **Carnegie Steel Company,** Pittsburgh, Pa., has been appointed vice-president in charge of sales of the **United States Steel Corporation,** with headquarters in New York, succeeding **E. P. Thomas,** who has been assigned to special duties. **Clement V. McKaig,** vice-president of the **Great Lakes Steel Corporation,** has been appointed vice-president and general manager of sales, of the **Carnegie Steel Company,** at Pittsburgh, to succeed Mr. Wood.

Mr. Wood was born on September 11, 1873, at Youngstown, Ohio, and was educated in mining engineering at Ohio State University. He entered the industrial field as a chemist with the Calumet Furnace Company, Chicago, and when this company suspended operations Mr. Wood engaged in mining engineering in Colorado and other western districts. In 1896, he became affiliated with the American Steel Hoop Company, and subsequently was appointed manager of the order department. Upon its consolidation with the Carnegie Steel Company and with the formation of the United States Steel Corporation, Mr. Wood was transferred to the sales department of the former company. He has served successively as assistant general manager of sales in charge of bar, hoop and band production and general sales manager and vice-president.

Mr. McKaig was born at Pittsburgh and was educated at Princeton University. He entered the steel business with the old Park Works of the Crucible Steel Company, Pittsburgh, working through a number of departments to the superintendency of the bar mill. In 1908 he joined the Carnegie Steel Company and on April 1, 1929, he became general manager of bar and hoop production, including design, engineering and marketing of all special bar mill products. When the Great Lakes Steel Corporation, Detroit, Mich., began operations later in 1929, Mr. McKaig became its vice-president in charge of sales; he now leaves that position to return to the Carnegie Steel Company.

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Use NO-OX-ID FILLER RED on the outside of wayside tanks and supports, elevated water storage tanks and water columns and water treating tanks. Also on bridges, turntables, signal bridges, signal masts, especially under clamps holding brackets, etc., trestles and viaducts, over which may be applied your standard specification paint.

Some very striking color combinations have been worked out over a base of NO-OX-ID FILLER RED and the added life of the equipment more than repays the investment in scientifically correct rust inhibition of the metal. FILLERS are made also in gray and black.

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MAKE your track dollar go further by increasing the service life of costly frogs, switches and crossovers. Hallen Welding Service, Inc., rebuilds all worn trackwork under traffic without track disturbances or traffic interruptions.

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ALPHABETICAL INDEX TO ADVERTISERS

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In the steel industry. Timken Bearings are carrying loads as high as *8 million pounds* in rolling mills; reducing power consumption as much as 50 per cent; and extending the life of mill roll neck bearings by hundreds of thousands of extra tons rolled without bearing replacement. The largest plate mill in the world is equipped with Timken Roll Neck Bearings weighing 3½ tons each.

In the paper industry. Timken Bearings have greatly increased the operating speed, economy and dependability of all types of paper mill machinery. The largest paper making machine ever built is completely Timken-equipped, containing more than 1500 Timken Bearings. One prominent paper manufacturer has increased super-calender production 37½% and cut power costs 50% by Timkenizing his equipment.

In the construction industry. Many construction machinery manufacturers and contractors depend on Timkens for operating economies, speed, dependability and uninterrupted service ... in power shovels, concrete mixers, pavers, graders, conveyors, hoists, gasoline engines, pumps and all other types of equipment. Moving a huge hill from the middle of a large western city without interfering with traffic is one of the most spectacular accomplishments ever recorded in this field. It was done by means of a Timken-equipped belt conveyor system. Timkenized equipment is being extensively used in the construction of the Hoover Dam at Boulder Canyon.

In the oil fields. More Timken Bearings are used throughout the oil fields than any other type of anti-friction bearing—in drilling, pumping and auxiliary equipment of every type. Many of the world's deepest oil wells were drilled with Timken-equipped oil field machinery.

In the mining industry. Timken has been the dominant anti-friction bearing in mine cars for more than 10 years. Nearly 1,000 mine operators use Timken Bearings in more than 150,000 mine cars. Timken-equipped cars speed up coal haulage; increase output; reduce production costs and cut maintenance expense to the bone.

In the machine tool industry. Timken Bearings have so radically revolutionized spindle operation by preventing chatter; eliminating friction; and making possible continuous high speed operation, that over 95 per cent of all new heavy duty machines are equipped with Timkens on spindles.

In automotive vehicles. Over 90 per cent of all makes of passenger cars, trucks, buses and tractors are equipped with Timken Bearings at the important points of application ... front and rear wheels, transmission, pinion, differential and steering. Timkens have received the preference of leading American motor car manufacturers for 34 years.

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